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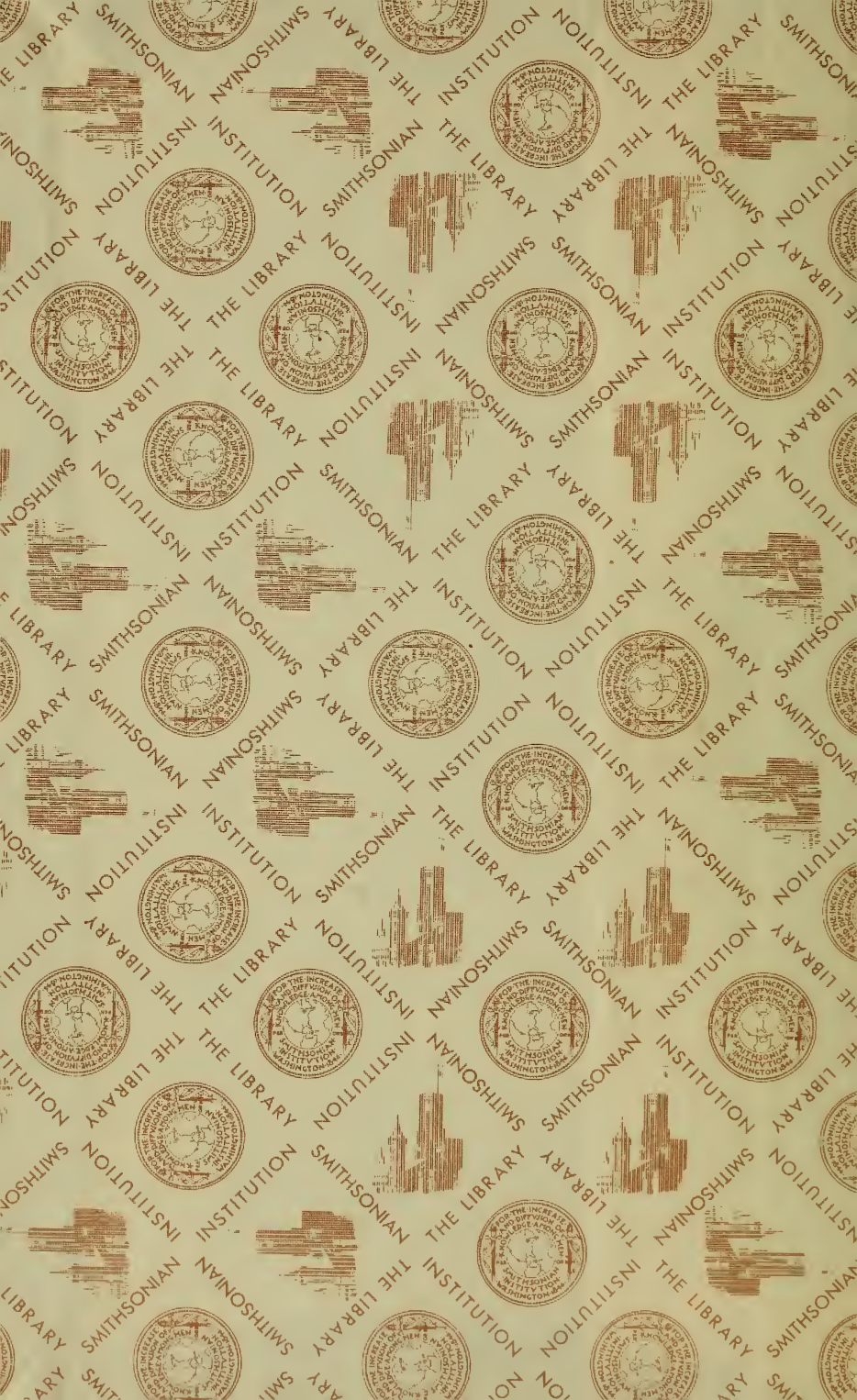
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THE CHESAPEAKE AND OHIO RAILROAD.

The Chesapeake and Ohio Railroad connects the navigable waters of the Chesapeake Bay with the Ohio River at Huntington—distant 423 miles from the James River wharves at Richmond, Virginia.

The harbor facilities of the Company are good, and vessels load readily for foreign ports. The present available depth of water up to the Chesapeake and Ohio wharves is 15 feet, and is in process of improvement to 16 feet under supervision of the United States Engineers.

Regular lines of steamers ply between these wharves and the cities of Norfolk, Baltimore, Philadelphia, New York and Boston, and fleets of sailing vessels bear an increasing trade to home and foreign ports.

Connections are had at Richmond with the Southern Railway system, and at Staunton and Gordonsville with the Northern lines. At Huntington the excellent steamers of the Cincinnati, Big Sandy and Pomeroy Packet Company afford admirable freighting and passenger communications with the West.

Efforts are on foot, with a fair prospect of success, for the early completion of all-rail commmunication with the Western Cities and railroad system which, when consummated, will make the Chesapeake and Ohio Railroad one of the most important trunk lines in the country.

Character of the Work.

The road is of the standard gauge, 56½ inches, common to the greater part of the American railroad system. In its construction the most modern and approved plans and materials have been adopted. Iron bridges have been erected in the portion more recently built, with solid masonry abutments and piers for double track in important cases. Steel rails were laid on a large part of

the Western Division, over which a heavy mineral traffic passes, and other portions of the road are being relaid with steel; culverts and water-ways have been made of more than ordinary massiveness and durability; and solid embankments have been built in most cases in place of trestle-work.

Originally designed and laid out on a thorough and comprehensive plan as a great central highway between the extensive system of internal navigation on the Western Rivers, and the most central and commodious harbor on the Atlantic coast line of the United States, it is a splendid achievement of modern engineering skill, and in addition to its advantages in occupying the best natural pass over the Alleghanies, which was designated at a very early day as the most desirable central route between the East and West, it stood, at the date of its completion, in a much more perfect condition, in its alignments, grades, construction, equipment, resources and connections, than any of the other great Trunk Lines at the same period of their history.

In the passage from the sea-shore to the navigable waters of the West, the road crosses the Blue Ridge and the Alleghanies by very easy grades, the highest elevation attained being about 2,070 feet, and the descent on the Western slope is made with remarkably light and uniform grades, and without noticeable undulations.

The several ridges are cut through by natural water-gaps, or depressions which have in places also been tunnelled far below the general level of the range.

No care or expense has been spared in its construction, which was necessary to render it a thoroughly first-class and substantial railroad, and the liberal outlay for first construction in securing a solid and enduring road-bed, masonry, bridges and superstructure, which neither the lapse of time nor the action of the elements can seriously impair, will result in great saving in its maintenance and repair, and in the expense and regularity of its operation. The current expenses for renewals and repairs, both of the track and rolling-stock, will be much less than on more hastily and cheaply constructed roads.

Among the special advantages of the Chesapeake and Ohio Railroad route for the transportation of the surplus productions of

the West, and a corresponding movement of merchandise in the other direction which are attracting the attention of producers and shippers, are the following :

I. *Short Portage between the Ocean and Ohio and Mississippi River Navigation.*

II. *Direct Railroad Connections, in progress and projected, to the chief Cities of the West.*

III. *Light Grades and Curves.*

IV. *Cheap Fuel.*

V. *Genial Climate.*

I. *Short Portage connecting important Water Lines.* By a glance at the map it will be seen that the Chesapeake and Ohio Railroad has an Eastern terminus at the most westerly tide-water port of the North Atlantic Coast (Richmond), or, in other words, the port of shipment which is geographically nearest the centres of the Ohio and Mississippi Valleys, while at the same time it is nearer the open sea than Baltimore.

The deep water or extreme eastern terminus of the Road will open directly upon the Chesapeake Bay ; by far the most accessible, convenient and secure harbor of the entire Eastern coast, the value of which as a sheltering roadstead and as a commercial rendezvous, is well established. It is always free from ice, and vessels can enter and leave it at all seasons of the year without obstruction. The sailing time between Hampton Roads and European ports is no greater than between New York and the same ports, while it is nearer the open sea than either Boston, New York, Philadelphia, or Baltimore.*

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*Commodore Maury, of Virginia, better known to science as Lieut. Maury, from his researches on the laws of currents and deep sea lore, speaking of the relative merits of Norfolk and New York as commercial harbors, says of the roadstead in the vicinity of which the deep water terminus of the Chesapeake and Ohio Railroad will be located, and which is common to vessels seeking the wharves at Norfolk, Yorktown, or New Port News, thus describes it : "Geographically considered, the harbors of Norfolk or Hampton Roads and New York occupy the most important and commanding positions on the Atlantic coast of the United States. They are more convenient

The western terminus of the Road is situated upon the Ohio River at the point where that stream begins its general westerly course; or in other words the most easterly point of its navigation in proportion to the total distance traversed; below the principal obstructions to navigation, and at the head of that part of the river which is swollen by large Southern affluents, and where longer seasons of navigation and better stages of water are combined than at any point higher up.

Connecting an inland river system of from 12,000 to 20,000 miles of navigable streams with the ocean commerce of the world by a low-grade route, the Chesapeake and Ohio Railroad possesses a very marked advantage for the transportation of freights between the East and West. Insufficient depth of water, shortness of navigable seasons, sand-bars, and other obstructions have rendered the cheaper transportation of the Western waters almost unavailable in connection with the other great East and West lines of Railway, and have driven them, each in turn, to rely upon all-rail lines almost exclusively.*

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to the ocean than Baltimore, Philadelphia and Boston, because they are not so far from the sea.

"Depth of water that can be carried out, and distance of the sea from

Hampton Roads,	distant	15	miles—depth		28	feet
New York,	"	30	"	$3\frac{3}{4}$ fathoms,	23	"
Boston,	"	100	"	$3\frac{1}{2}$ "	21	"
Philadelphia,	"	100	"	$3\frac{3}{4}$ "	23	"
Baltimore,	"	160	"	$2\frac{3}{4}$ "	16	"

"Between the three last and the sea there is a tedious bay navigation, but each of the first two is situated upon a well sheltered harbor, that opens right out upon the sea with beautiful offings, those of Hampton Roads surpassing the others in all the requirements of navigation, both as to facility of ingress and egress, certainty of land fall, depth of water, and holding ground."

He also shows, that to reach the Chesapeake, vessels cross the Gulf Stream at its narrower part, and take advantage of the eddies on its south-eastern edge; going in the opposite direction to Europe by following the Gulf Stream for a longer distance, will be helped along their course 50 to 100 miles per day.

*Should it be found desirable, the Chesapeake and Ohio Railroad can take the traffic from river barges and boats at the head of navigation on the Kanawha, at a point 87 miles east of Huntington. This would lengthen somewhat the proportion of the cheaper water transport and would reduce the land carriage to Richmond to 336 miles.

The tonnage of steamers and barges plying on those streams and other tributaries was, in 1872, 448,000 tons, of which 287,360 tons was propelled by steam.

For a good portion of the year, Steamers and barges can leave Huntington and proceed continuously to New Orleans and Shreveport in Louisiana, Natchez, Vicksburg and Yazoo, in Mississippi; Little Rock and Jacksonport, in Arkansas; Memphis, Nashville and Johnsville, in Tennessee; Cairo, Peoria, Alton and Quincy, in Illinois; Saint Louis, and Saint Joseph, in Missouri; Leavenworth, in Kansas; Omaha and Sioux City, in Nebraska; Saint Paul and Lacrosse, in Minnesota; Davenport, Dubuque and Burlington, in Iowa; Evansville and New Albany, in Indiana; Paducah, Louisville and Covington, in Kentucky; Cincinnati, Portsmouth and Ironton, in Ohio.

Among the leading products of the Western States which can be cheaply brought to the seaboard by the water lines to Huntington, and thence by the Chesapeake and Ohio Railroad to the coasting or foreign vessels, to great advantage, are wheat, indian corn, flour, pork, live stock, tobacco and cotton. The available surplus of grain from the territory naturally tributary to the Ohio and Mississippi Rivers, amounts to millions of tons. The figures showing receipts of flour, wheat and corn, at lake ports, and at the river cities, give some idea of the actual movement of breadstuffs. But these fall far short of the capacity of the same region to furnish breadstuffs when the cost of transportation will justify their production and shipment. The number of cattle, sheep and hogs which find their way to the Eastern cities is not readily obtainable, but the receipts and shipments of cut-meats and salted provisions, and the number of hogs slaughtered at the principal packing-centres will give an idea of the immense tonnage from provisions alone.

The total shipment of Western tobacco received on the Atlantic seaboard in the year 1875, is stated at 225 millions of pounds, the greater part of which finds market and manufacture at the Eastern cities, and in Europe. The bulk of this tobacco comes through St. Louis, Evansville, Louisville and Cincinnati.

In 1870, it was ascertained that no less than 350,000 bales of cotton were sent overland by rail from the river cities to the sea-ports of the North.

The Chesapeake and Ohio Railroad, with its connecting water lines, at either terminus, offers special inducements to shippers of all the above products destined to either home or foreign markets.

For the transportation of corn, bacon, bulk meat, &c., from Cincinnati and other Western markets to the South Atlantic States, where very large quantities of these products are consumed, it affords a far quicker and more economical route than has heretofore been open to that trade.

(2.) *Short All-Rail routes to the Western Cities.* The advantages of the Chesapeake and Ohio Railroad for through business are not confined to its favorable connection with water lines merely, nor to the carriage of freights alone. With the various rail connections, now projected, and which must ultimately be built, it will afford the best eastward exit and entrance of the Ohio Valley, whether considered in relation to available water transport or to continuous railroad routes. Both in distance and in other working elements, it is a short, economical line between the seaboard and the principal cities and railroad centres of the Western States, and offers the most advantageous outlet to the Ocean for an immense system of interior Railroads.

The following table will illustrate the general directness of this route, and show the comparative distances between the several tide-water ports and the chief cities of the West and Southwest. It will be seen that the advantage ranges from 30 to 300 miles in distance, and covers the principal cities, with the exception of Chicago and Columbus, where there is a trifling excess over two other lines, if linear measurement only is reckoned. With a due equation of grades it will be found to afford the shortest and best route to the sea-board, even from those points.

TABLE *showing Comparative Distances between Atlantic Ports and Principal Western Railroad Centres by All-Rail Travel, by CHESAPEAKE AND OHIO RAILROAD and its projected connections, and by more Northerly Routes.*

MILES FROM PORT OF	To Cincinnati.	To Louisville.	To St. Louis.	To Memphis.	To Nashville.	To Columbus, O.	To Indianapolis.	To Chicago.
Richmond, via. Ches. and Ohio.....	573	*643	*890	1020	828	557	688	833
Baltimore, via. Balt. and Ohio.....	580	697	929	1076	884	517	705	828
Philadelphia, via. Penn. R. R.....	668	775	992	1152	960	548	736	823
New York, via. Erie Railway.....	861	997	1201	1354	1182	755	935	983
New York, via. N. Y. Central.....	883	940	1144	1354	1176	761	830	980
Boston, via. N. Y. Central.....	941	998	1202	1426	1234	829	888	1038

*Will be shortened 13 miles by improvements now in progress.

Between all points of the West or Southwest and Washington City—to which place as the National Capital there must always be a large passenger travel—the Chesapeake and Ohio, with its projected rail connections completed, will afford the shortest and best communication; and Chicago, Omaha, and points in the Northwest may adopt it with advantage. Comparing the distances between Washington and the large cities of the West over the several routes, we find a saving of from twenty to ninety miles in favor of the Chesapeake and Ohio route.

TABLE *showing the Distances between Washington and Western Cities via the Chesapeake and Ohio and Other Routes.*

DISTANCE FROM WASHINGTON, VIA	TO CINCINNATI.	TO LOUISVILLE.	TO MEMPHIS.	TO NASHVILLE.	TO ST. LOUIS.	TO CHICAGO.
Chesapeake and Ohio Railroad.....	593	660	1,037	845	910	852
Baltimore and Ohio Railroad.....	613	720	1,097	905	953	852
Pennsylvania Central Railroad....	646	753	1,130	938	989	842

Between New York and Southwestern cities, the advantages of the Chesapeake and Ohio Route are as decided for passenger travel as for the transportation of freights. From St. Louis, Cincinnati, and points farther South, the distance to New York will be shorter than by the Erie or Lake Shore routes. Estimating the influence of difference in grades, it will also be shorter, in time, between the same points than either the Pennsylvania or Maryland lines.

From New Orleans, Memphis, and the lower Mississippi, the Chesapeake and Ohio is the most direct and quickest route to all points along the seaboard.

DISTANCE FROM NEW YORK, VIA.	TO LOUISVILLE. MILES.	TO MEMPHIS. MILES.	TO ST. LOUIS. MILES.	TO NEW ORLEANS MILES.
Chesapeake & Ohio R.R. via Wash'n	888	1,265	1,138	1,394
Erie Railway, via A. & G. W.....	997	1,354	1,201	1,751
N. Y. Cent'l, via Lake Shore & M.S.	940	1,354	1,260	1,694

III. *Light Grades.* The line of the Chesapeake and Ohio Railroad is remarkable for the uniformity and lightness of its grades. From the western terminus of the road at the Ohio river to the summit of the Alleghanies, 208 miles, the grades are without noticeable undulation, and with a nearly uniform ascent, averaging ten feet per mile, and in no case exceeding thirty feet per mile, or one in 175. From the summit eastward to Clifton Forge, where the line crosses the waters of the James river, a further distance of twenty-three miles, the grades are descending, nowhere exceeding sixty feet per mile. On the remainder of the line to Richmond the average grades are light, there being less than ten miles, in all exceeding sixty feet; and at these points a reduction to the maximum of sixty feet is practicable.

The full force of this advantage and of long stretches of level, or nearly level, track may be better understood by the statement that the same freight engine (of suitable power) will be able to leave Huntington on the Ohio River with its maximum load (of say 50 cars), and proceed without interruption eastwardly for 231 miles, across the summit of the Alleghanies, at a nearly uni-

form speed, without encountering any opposing grade of over 30 feet per mile, and without requiring any auxiliary power.

Other east and west Trunk lines are now resorting to every practicable expedient, and preparing to expend large sums, to reduce their grades, which in some cases are as high as 120 feet per mile.

In the carriage of heavy freights, such as produce, coal, iron, and other minerals, as well as of passengers and the "quick-despatch" freights, low grades are of the utmost importance both to the rapidity and the economy of transportation. The following table, compiled from the published data of a large locomotive manufacturing establishment, in Philadelphia, gives the relative hauling power of freight engines over different grades, showing a very rapid loss of power as the grades increase:

"Mogul" Freight Locomotive.

Maximum load on level grade				1,400	tons.
"	"	20 feet		655	"
"	"	40	"	415	"
"	"	60	"	300	"
"	"	80	"	230	"
"	"	100	"	180	"

IV. *Cheap Fuel, &c.* In the supplies of equipment, machinery, rolling stock, castings and wrought-irons, timber, fire-wood, lubricating oils, and other items, involving large expenditure for the operation and maintenance of railroads, the Chesapeake and Ohio Railroad has very decided advantages. Timber, of all desired sorts, borders the line; the oils of West Virginia are the best known for railroad uses; labor is cheaper than the average cost elsewhere.

In fuel for locomotives, which is one of the largest items of expense in railroad operation, it has unrivalled advantages. The best steam coals abound in thick seams in close proximity to and above the level of its track, and can be supplied to its locomotives at the bare cost of handling. It is believed that the Company's entire supply can be furnished for an indefinite period at one dollar per ton, or from one-half to one-fourth the average cost of fuel to some of the other lines.

V. *Genial Climate.* Lying along and near the 38th parallel of

latitude, the Chesapeake and Ohio Road enjoys a mild and equable climate, exempt from extremes of heat or cold. The winters are much shorter and more temperate than in Pennsylvania or New York. There is never any obstruction from deep snows, nor liability to interruption from extreme frosts. The losses to which more northerly lines are subjected, and the delays and disadvantages to shippers, resulting from these causes in winter, will be unknown upon this route; and its general and uninterrupted freedom from obstruction and delays during the seasons when the efficiency of some of the most important routes is more or less impaired, will render it the most desirable winter route for both freights and travel.

Resources and Attractions of the Country along the Route of the Chesapeake and Ohio Railroad.

The region traversed by the Chesapeake and Ohio Railroad is by reason of its natural advantages of soil, climate and agricultural and mineral wealth, one of the most attractive and inviting in the United States, and offers at the present time probably greater opportunities for the active and profitable employment of capital and labor than almost any other section of our country.

It abounds in almost every element of material prosperity, health and enjoyment, and opens to tourists, capitalists, coal operators, iron workers, manufacturers, mechanics, farmers and emigrants from the Eastern States and Europe, a field unequalled in the great variety and rare combination of its advantages.

Many of the remarkable resources peculiar to the region traversed by the more recently opened portion of the road, though long known to scientific men and explorers, have, in the absence of available communication, been heretofore secluded to a great extent from practical utility and development, and from popular knowledge.

The completion of the railroad gives to them at once a new interest and importance, renders them accessible to capital and industry, and brings them into quick and economical communication with the great centres of consumption and commerce.

So great is the interest which the opening of the Railroad has awakened throughout this country and in Europe, and especially in England, respecting the advantages for settlement, the opportunities for the investment of capital in the purchase and development of agricultural, iron, coal and timber lands, and the facilities for business enterprise, along the route; and so numerous are the enquiries for more specific and detailed information than has heretofore been given in condensed and collected form, that it is proposed to present in the following pages, a brief and comprehensive sketch of some of the most important of these resources and advantages, and their prominent localities, with some directions and references calculated to be of interest and service to persons desiring to visit or investigate them. Among the most conspicuous and available are:

(1) *Soils of great variety and fertility, adapted to every branch of husbandry, field, fruit and vine culture, and the raising of live stock; forests of the best Oak, Yellow Pine, Walnut, Poplar, and other valuable Timber, with an admirable climate, and choice farm and timber lands at moderate prices.*

(2) *Extensive deposits of Iron Ores of great variety and richness, with abundance of Limestone, Timber, cheap fuel, and other conditions for the profitable manufacture of Iron.*

(3) *The great Kanawha and New River Coal Fields, containing the best Cannel, Splint, Bituminous and Gas Coals in veins of remarkable thickness and purity, situated above the level of the Railroad, and accessible at a very low cost for mining.*

(4) *Salt Wells, Roofing Slates, Cement, Gypsum, Clays and other miscellaneous minerals of commerce, and superior materials and advantages for the production of Soda-ash, Bromine, &c., &c.*

(5) *Favorable locations, and the material accessible at a low cost, for almost every variety of manufacture and mechanical industry, water power, &c.*

(1) Soils and Agricultural Lands.

In its course from the ocean to the Ohio River, the Chesapeake and Ohio Railroad passes centrally through the two great States of Virginia and West Virginia, touching some of the oldest and

largest towns and cities, and passing through some of the richest and most productive lands, embracing nearly all varieties of soil, herbage, and climate to be found within the temperate latitudes.

The geological formation, the topographical features, the water-shed and the elevation above sea-level give to the several portions of the territory distinctive characteristics which have caused them to be designated separately as the "Tide-water," the "Middle," the "Piedmont," the "Blue Ridge," the "Valley," the "Mountain" or "Appalachian," and the "Trans-Appalachian" or "Ohio Valley" regions; each and all of which have unusual agricultural attractions, and are suited to the widest range of agricultural pursuits.

The Tide-water Region consists of a series of extended peninsulas, whose sides are washed by the Chesapeake Bay and tidal rivers, (most of them navigable,) affording a long and irregular coast-line, with easy access to the markets of the seaboard and to the interior towns and cities. The land is well-drained; generally free from marsh, with a soil of clay, marl and sand, and an overgrowth of pine and oak.

The principal item of land culture in this region is market gardening, for which it is well adapted; the spring season in the warm lands in the vicinity of Norfolk, Newport News and Yorktown opening by the first of February. The annual shipment of early vegetables to New York by sea is estimated at $20,000,000, exclusive of the amount sent inland, and the trade is steadily increasing.

A large amount of farming land is under cultivation, the staple crops being Indian corn, wheat, potatoes, sweet potatoes and peanuts. In one of the counties bordering on the James River, the average yield of wheat, for the plantation, was 35 bushels per acre. Orchard fruits are also grown and shipped to a large extent.

Good farming lands are to be had at points along the peninsula bounded by the York and James Rivers, at prices varying from $10 to $50 per acre, according to their proximity to the navigable channels or to the railroad line. Labor is abundant and the cost of living low. The "marl," found but a short distance inland,

and the limestone crossed by the railroad can be cheaply and abundantly supplied as fertilizers, and an unlimited market invites to the rapid expansion of the industries of this and the adjacent region.

The waters of this Bay, and its numerous indentations are almost as valuable to commerce as the lands; the extensive oyster beds and fisheries being among the best in America. Oysters are shipped from Norfolk and vicinity to eastern seaboard cities in immense quantities. The total amount drawn from these waters annually is estimated at 30,000,000 bushels; the State tax being collected on 20,000,000 bushels. Large quantities of oysters, as well as of shad, herring, and other fish, are now sent to the cities of the Ohio and Mississippi Valleys, by the Railroad.

The location of the deep-water terminus of the Chesapeake and Ohio Railroad, near the extremity of the chief peninsula of this tide-water region between the York and James Rivers, and the growth of an important seaport at that point, will impart a new activity to all that region, and greatly increase the value of its productive resources.

The Middle Country has a width of about sixty miles, and an area of 12,000 square miles. The rivers of the interior and the tidal waters of the ocean meet at its eastern edge, as the former fall over the uplifted granite rim, bringing together navigable water courses to the sea and numerous and effective water-powers, and making of inland seaports advantageous sites for manufacturing, milling and other industries The James River falls about 70 feet near Richmond, yielding a power for milling purposes exceeding that of Lowell.

The surface of the country consists of slight undulations, with a gradual ascent to 500 feet above sea level at its western border at the South-west Mountain, as it is locally called, a low, outlying ridge, having a general elevation of about 500 feet above the plain at its base, whose sides and summits are, for the most part arable land. The soils formed from a variety of rocks, are various, ranging from the light brown of the ridges, to the rich, dark brown of the bottom lands.

The principal farm products are wheat, corn, flax, grass seeds, sweet potatoes, oats and tobacco, with a large representation of cattle, sheep, etc. The three counties of Henrico, Hanover and Louisa of this belt, which are traversed by the railroad, may be taken as specimens of the average. Their productions were, according to the census of 1870:

Acres improved	315,196
Acres unimproved	302,564
Cash value of farms	$11,055,990
Value of all live stock	$ 818,209
Wheat crop (bushels)	329,859
Corn crop (bushels)	504,625
Tobacco (pounds)	1,380,835

In 1860* the average production of tobacco was 246 pounds to each inhabitant. The average value of farms in twenty-one counties was, in 1860, $12.50 per acre. Lands in these counties are held at low prices, improved lands being obtainable at from fifteen to twenty dollars per acre. No part of the belt is distant more than ten or twelve hours from the tidewater ports by railroad, and it is thus within easy reach of good markets.

The poorest of the soils may be enriched by the abundance of the marl or "green sand," a fossil manure of great value, which is found and worked along the course of this railroad, the beds having in places a depth of fifteen feet. More than a million tons per annum of the same description of marl have been dug and distributed in the State of New Jersey (Monmouth county alone furnishing 600,000 tons), where its value as a fertilizer is well understood, and creates a large demand for it at high rates.

The gathering and grinding of sumac leaves, found in abundance in this and other sections of Virginia, along the route of the railroad, is another important source of profit to farmers. The value of the extracted dye-stuff is superior to that of Sicily, and it commands a high price in English markets. The demand for it is almost unlimited, the importations into the United States being 2,000,000 pounds annually.

*The census of 1860 is quoted as showing more accurately the condition of these counties, which in 1870 had not fully recovered from the effects of the war.

Inquiries concerning lands held for sale in Eastern Virginia, adjacent to the line of railroad, may be addressed to Gen. Wms. C. Wickham, the Vice President of the Company, at Richmond.

The Piedmont Region, as its name indicates, consists of the foot slope of the Blue Ridge, and is divided into a tier of counties covering an area of 6,000 square miles. There were in 1860 some 2,000,000 acres in cultivation. About the same quantity unimproved was inclosed in farms, leaving over half a million acres as wild land. These proportions had not greatly changed up to 1870; but of late there has been a considerable influx of immigrants from the northern States and Europe, who have been enabled to purchase improved estates, with fences and good buildings on them at from $15 to $50 per acre, including improvements.

It is crossed by the Railroad in Albemarle County in a distance of twenty-five miles. It includes several spurs or ridges lying within the enclosing hills, all of them arable to their summits. By soil, climate, scenery, chemical constituents, and distribution of water, these lands are entitled to rank among the finest in America. The variety and exuberance of the productions attest their capacity for agriculture. The soil is for the most part a friable, red crumbling loam, very easily worked.

To a population of 202,282 in thirteen counties, according to the census of 1860, there were over $7,500,000 worth of live stock; eight millions of bushels of cereals, or forty bushels per capita, were raised and of tobacco 24,000,000 pounds, or 120 pounds per individual. The grasses, grains and orchard fruits of this part of Virginia are celebrated. Prof. Ridgway, in a Geological Report of this region says:

"The Piedmont District, in Albemarle and Nelson Counties, has a mixed subsoil, rich in fertilizing ingredients, such as lime, magnesia, potash, oxide of iron, &c., derived from the rocks beneath. Hence wheat, corn, oats, tobacco, the natural Virginia blue grass, English sward, clover, timothy, orchard and herd's grasses flourish luxuriantly; also fruits of various kinds, the pippin apple, pear, and grape attaining unusual dimensions, flavor and perfection."

By the census of 1860, Albemarle County showed a population of 26,000; with 700 square miles of territory, half of which was

enclosed in 900 farms, 500 of which contained over 500 acres each. Its annual products were:

Wheat, Corn and Oats—(bushels)	1,250,000
Tobacco—(pounds)	5,500,000
Potatoes—(bushels)	40,000
Wool—(pounds)	40,000
Butter—(pounds)	200,000
Live Stock—(head)	60,000
Value of products of farms	$2,000,000

The Blue Ridge Country has the same general characteristics of the Piedmont and Valley districts, and these together form pre-eminently the Fruit and Grain region of Virginia.

Major Jed. Hotchkiss, of Staunton Va., in a paper on "The Resources of Virginia," read before the Society of Arts in London, and reported in the Journal of the Society, in February, 1873, in referring to this section, says:

"Some 3,000 square miles, or two million acres, of Virginian territory pertain to the Blue Ridge—a region twice the size of your Sessex—most of it covered with a fine growth of original oak, hickory, chestnut, and tulip-poplar forest, with here and there a valuable grazing or fruit farm, a patch of lighter green on the sides or summits. These greenstone rocks, as is well known, crumble into soils rich in color and in the elements of fertility—soils especially adapted to the wants of the vine, such as most of the world's great vineyards are situated upon. The forests of the Blue Ridge abound in grape vines of a large size and very productive—the originals of the Catawba, Norton's Virginia, and other well-known American grapes; and thousands of gallons of brandy are annually distilled from these by dwellers along the mountain—one man having made 11,000 gallons in a season. Recalling what was said of the topography of this range, it will be seen that almost any aspect can be chosen for a vineyard; the soil has a special adaptation to the vine, the latitude—that of France—gives length of season, while the elevation, above the "frost line" of the valleys, secures the maturity of the grape, an indispensable requisite for the production of good wine. Numerous vineyards are now in successful operation; at Belmont, near Front Royal, is one, covering some seventy-five acres, that has now an annual yield of 20,000 gallons of wine, the pure juice of the grape, and 10,000 gallons of brandy, the vines that are in full bearing yielding from 300 to 500 gallons of wine to the acre. The grapes are notably rich in saccharine matter, and diseases of the vine are unknown. Nearly a million acres here are adapted to this culture, and offer a pleasant and profitable field, and a virgin soil in a most genial climate for this leading industry.

"This section has also an established reputation as a fruit-producing one,

its apples, pears, peaches, and other temperate climate fruits attain a flavor and perfection rarely equalled elsewhere; its Albemarle pippins command prices that have induced the planting of large orchards of that single variety. It is no uncommon thing for 500 bushels to be gathered from an acre, and an English eighteen pence per bushel would yield a large profit to the orchardist. The day is not distant when Blue Ridge apples will form a staple article of export to Europe, and one of the greatest blessings that can be conferred upon any people is an abundance of cheap fruits to take the place of stimulating drinks."

As has been stated there is still abundance of unimproved land for sale in this section, and here and there are improved farms which may be had at prices, which, though higher than those further east and further west on the line of the road, are nevertheless comparatively cheap in view of their natural advantages and nearness to market.

The Valley Region. Between the Blue Ridge and the next range of mountains to the west lies "The Great Valley," or, as it is sometimes called, "Limestone Valley of Virginia," of which the renowned Shenandoah Valley forms a part. It is a continuation of the famous Goshen Valley of New York State, and the Lebanon and Cumberland Valleys of Pennsylvania, though having far greater dimensions. It is crossed by the Chesapeake and Ohio Railroad in a distance of thirty-five miles. At Staunton the Valley has an elevation above sea-level of 1,100 feet, and is shut in and sheltered by enclosing ridges 3,000 feet on the eastern or Blue Ridge side, and 1,000 feet higher on North Mountain side.

The Valley is notable for its grain and grass-growing capacity. It includes about 5,000,000 acres of land, of which 1,700,000 are under some form of cultivation; 1,800,000 additional being inclosed in farms, and the remainder, or a third of the whole, available for fresh settlements.

Some idea of the productiveness of its soil may be gathered from the census figures of 1860, which gave as the total value of farming implements, $7,000,000; with 58,000 horses, 2,000 mules, 49,000 milch cows, 3,500 working oxen, 101,000 other cattle, 139,000 sheep, 254,000 swine; 606,500 head in all, valued at $8,000,000. The annual value of animals slaughtered was $1,850,000; the wool clip was 500,000 pounds, the flax yield 66,000 pounds,

and from these a domestic manufacture of $250,000 was reported. The wheat product was 3,250,000 bushels, corn 5,500,000 bushels, besides large crops of rye, barley, oats, buckwheat, &c.; 370,000 bushels of potatoes, 120,000 tons of hay, 27,000 bushels of clover seed, 25,000 bushels of grass seed, 2,750,000 pounds of butter, 55,000 pounds of maple sugar, 171,000 pounds of honey, and 3,000,000 pounds of tobacco.

There are also raised large quantities of sorghum, syrup, wax, hemp, hops, silk, wine, cider, peas, beans, cotton, orchard products and other items, showing great variety in the resources and industry of this part of the State. Its comparative productiveness at that date is shown in the facts that while it had but 1-142 part of the whole population of the United States, it had 1-107 of the horses, 1-174 of the cows, 1-146 of the other cattle, 1-156 of the sheep, 1-132 of the swine, 1-135 of the value of the stock raised, and 1-57 (or nearly three times the average production) of the wheat, 1-120 of the wool, 1-115 of the oats, 1-35 of the clover seed, and 1-95 of the value of land under cultivation.

Augusta county, through which the railroad crosses the head of the Valley, is one of the richest in the State in agricultural values, and is underlaid with mineral treasures of vastly greater value, more particular reference to which is made in the pages following, under the head of iron ores. Its population and products, and the value of its agricultural lands will be greatly increased with the great impulse which will be given to iron ore mining and iron manufacture, by the recent opening of the railroad through to the abundant and cheap fuels of the Kanawha Valley, and to the iron furnaces of Ohio and the West, for which the Virginia ores are likely to be in great demand.

The multiplication of iron ore mines and blast furnaces will afford an increased home market for the surplus and increased production, which will still further add to the general prosperity which distinguishes this valley. Limestone of the purest kind being the bed rock of this region, it is cheaply dug, and by means of cheap coal-screenings drawn from the Kanawha can be cheaply burned into lime for fertilizing purposes, and must be in large demand for flux in iron smelting.

The leading items showing the present condition for agriculture of this county, as shown by the census of 1870, are as follows, viz:

Acres improved	222,843
Acres unimproved	178,028
Cash value of farms	$10,232,552
Annual value of farm products	$2,130,430
Value of animals slaughtered	$346,890
Value of all live stock	$1,086,917
Crop of wheat (bushels)	463,276
Butter (pounds)	353,335
Wool (pounds)	23,291

Numerous English settlers have purchased farms and estates in this vicinity.

Agricultural and wood-lands in this and adjoining counties are still to be had at moderate prices, $25 to $50 per acre; those containing the heavy veins of hematite ores, or timber lands adjacent thereto being held at somewhat higher prices.

The Mountain or Appalachian Belt of country has a width varying from 20 to 50 miles, and is about equally divided between the two States—Virginia and West Virginia—and consists of a great number of comparatively long and narrow valleys, formed by the head-waters of the Potomac and James River draining the eastern slope, and by the Monongahela and New Rivers flowing toward the Ohio. The population of the 20 counties (ten on each side of the boundary) was 142,336 in 1860, and 148,509 in 1870, a gain of near 4½ per cent. or an average of twenty persons to the square mile.

As may be imagined from the rugged aspect of the country, there are on the mountain slopes hundreds of thousands of acres of dense, unbroken forests. The prevailing timber consists of oak, hickory, pine, spruce, cherry, maple, walnut, beech, and poplar. It is not uncommon to find a hundred trees upon an acre, of hickory, white oak, tulip-poplar, or wild cherry, from each of which a stick of two feet in diameter, and forty to fifty feet long may be hewn; besides pines and spruces of still larger dimensions. The consumption of timber from the mountain districts of this same range in Pennsylvania and New York has been very large; a single county

in the former State having sent to market 500 millions of feet in a single year, at an average rate of 17 cents per cubic foot.

The want of railroad facilities has heretofore kept the Virginia forests out of market, while the price of timber lands in the two States above mentioned have greatly advanced in value as the railroads penetrated them.

The opportunity is afforded by the Chesapeake and Ohio Railroad to ship large quantities of hewn and sawed timber to both eastern and western markets from the cheaper Virginia forests. Lands can now be had in fee simple for from $1 to $10 per acre, from which timber to ten times the value could be cut from nearly every acre, and leave a large profit to the shippers, after payment of all expense of cutting and hauling to the railroad. The timber cutting upon the line has thus far been largely for local consumption, and in opening up the new country west of the Alleghany mountains. But already there has been a considerable exportation of log timber to Europe direct and via New York, which will, without doubt, largely increase. The foreign demand is chiefly for the choice grades of walnut, oak and poplar, for which the region, traversed by the Chesapeake and Ohio Railroad, is noted. The unusual size and quality of this timber has attracted attention at the shipping ports and abroad.

Upon the Western and Greenbrier divisions, good openings are also presented for the stave business, and the shipment of all cooperage stuff, locust treenails and posts, tan-bark and the forest products generally.

Howell Fisher, a practical Pennsylvania coal operator and iron master, who has made this region a special study, visiting it many times, says in regard to the agricultural capacities:

"On climbing up these mountains it is found that all the slopes and hillsides made by the numerous streams, and the table-lands on top, are covered with a rich mellow soil that raises with ease, and yields finely, wheat and corn, and particularly oats, potatoes, and all root crops in great abundance. This is the unanimous testimony of all persons acquainted with the country. On the south of New River, tobacco, said to be the finest sent to the Cincinnati market, is raised as easily and abundantly as in any part of old Virginia.

"Cattle and sheep fatten and flourish on the herbage and undergrowth without other food, and with literally no care. The size of the sheep thus raised

is stated by an intelligent gentleman, who has frequently passed through this country, and had his attention called to it, to be much greater than common, and their hardihood unusual.

"With this fertile soil, with a good climate, with the excellent water that always belongs to coal strata, and with unsurpassed healthfulness, this country, mountainous and hilly as it is, would have been filled with a hardy, industrious, and thrifty population, instead of the few settlements that are now met with, were it not for two causes, the principal one of which has been want of communication and market, and the other, the magnificent growth of timber with which the land is covered.

"This consists of large white, black, red, and chestnut oaks, black and white hickory, black walnut, ash, poplar, wild cherry, and chestnut, with occasional groves of the maple, and valleys of some size of the white pine and hemlock. There are other varieties, such as the dogwood, gum, etc., etc., which are not so numerous. When for some time among these forests, one does not so feel their size, but upon leaving the coal strata and coming to the Alleghanies, the trees there look dwarfish and the woods like a collection of brush.

"To the European immigrant, unaccustomed to the use of the axe, this fine growth of timber has been deemed an objection, and he has wended his way to the prairies of the West—with their chills and fevers, which most surely destroy the general health of his family—rather than undergo the unaccustomed task of clearing, in the mountain forests, the acres he needs. Even to our American woodsman this has been a serious task, arising from the necessity that heretofore existed of destroying the timber to get rid of it, in addition to the ordinary labor of clearing. Land when rid of this valuable timber has hitherto been worth five times as much as when covered with its natural growth.

"But with the railroad opened, giving easy access to Eastern and Western markets, all this is changed. There is a demand for the forest products and a road to market. The car builders, the cabinet makers, and the numerous industries, dependent upon cheap lumber, will necessarily come along the line of road. The unlimited supply of good bark will bring tanneries and their associate industries; and when to these demands is added the timber that will be marketed in bulk, and the large consumption for mining purposes, it will be seen how acre after acre will soon be opened to the husbandman, not only without cost, but with a large profit for the labor of clearing."

Although notably a timber-growing country, the mountain portion of Virginia and West Virginia is by no means destitute of general agricultural attractions. The extensive table lands and numberless valleys are suited for corn and grass culture, the soil being exceedingly rich and deep. There are also extensive plateaus, or table lands, between the depressions caused by the

washing of the streams, upon which are fine grazing and orchard lands.

It has been estimated by the Department of Agriculture that a steer can be fattened from the nutritious blue grass and corn of this section cheaper than in any other part of the country east of the Mississippi, and it is much nearer the great cattle markets than the Western grazing States.

There are still millions of acres available for field culture, orchards, vineyards, sheep pasture, etc., which are held as wild lands, and which may be had at from $1 to $10 per acre, according to their surface peculiarities and proximity to the railroad.

The Greenbrier Valley, one of the largest and oldest-settled of these depressions, is famed for its salubrity, beautiful scenery and general adaptability to farming pursuits. In appearance it resembles the renowned Wyoming Valley of Pennsylvania—having, however, a more luxuriant vegetation and finer views. The railroad enters this valley near the White Sulphur Springs, and follows its course to its confluence with the New River Valley, a distance of thirty-five miles. The substratum of nearly pure limestone which underlies this valley furnishes a rich soil. The limestone will be largely in demand for commercial, agricultural and mechanical purposes.

The climate of this belt of country is exceedingly favorable for man and beast. The isothermal line of 55° passes diagonally across it. At Lewisburg, elevated 1,800 feet above the sea, overlooking the Greenbrier, the average temperature in the spring months is 54°, of the summer 73°, the autumn 56°, and the winter 35°, giving an annual mean of 55°, or about the same as Baltimore and St. Louis, and higher than that of Philadelphia and Cincinnati.

The Trans-Appalachian or *Kanawha and Ohio Valley Region*, or, as it may be called the western foot-slope of the Alleghany range, is at present principally known for its wonderful strata of bituminous, splint and cannel coal.

The area in West Virginia is about 16,000 square miles. Its agricultural advantages are of great importance and value, though hitherto deemed subordinate to its great mineral wealth. The

improved lands in 1860 were one and a half million acres; the lands in farms, six million acres. There were over three million acres not held in farms—wild lands, generally owned in large tracts for their timber and undeveloped minerals. Timber lands can still be had in quantities at from $1 to $10 per acre, according to their surface peculiarities and proximity to the road. The average production of cereals was 33 bushels to the inhabitant, and 2 4-5 animals to the person.

The capacity of the bottom lands for corn-raising is equal to that of the best bottom lands in Ohio and Indiana, to which they are analogous. Tobacco and root crops can also be raised advantageously; the tobacco being so superior that it has taken premiums at several of the exhibitions of this crop. As a live stock country, it resembles the famous pastures of the uplands which border it on the east, and the notable "blue grass" lands of Kentucky which join it on the west.

Its location between the great markets of the east and west, and within twenty hours' travel of the seaboard and within forty-eight hours of New York, will enable cattle-growers to reap all the benefits of cheap feeding and economical transportation to market.

Active manufacturing and mining industries will be rapidly developed along the central portion of this belt, especially in the New River and Kanawha Valleys, on the line of the railroad, which will furnish a home market for local produce and render this portion of the country additionally attractive to settlers and farmers.

Sumac and oak bark, largely in demand for tanning and dyeing purposes, are found here in abundance, and tanneries here would have hides and ingredients accessible at a minimum cost.

IRON ORES AND FACILITIES FOR THE MANUFACTURE OF IRON AND STEEL.

The extensive and very valuable deposits of iron ore, and of coal, in the country traversed by the Chesapeake and Ohio Railroad have attracted the careful attention of experts and capitalists, who now rank this field of production among the most important of the United States.

The resulting advantages for the manufacture of iron (and, in due time, steel) are certainly somewhat exceptional; for at this time of extreme depression in the iron and coal trade, almost the only ore mines and iron furnaces operated in Virginia are those of the Chesapeake and Ohio Railroad. This fact means more, when it is considered that the new furnace construction upon this Railroad was commenced about the date of its opening for traffic, in the summer of 1873, was prosecuted through the commercial panic which followed and completed upon falling markets, with the additional weight of the largely increased outlay now essential for the enlarged dimensions and improved machinery of the later blast furnaces.

Yet in this short period, and in the face of these difficulties, enough has already been accomplished to demonstrate that very superior iron can be made at low cost from the ores, fuel and fluxes which abound upon the line of this Railroad—a result only possible with unusual local advantages. The steadily increasing tonnage in ores, iron and coal, at such a time and under circumstances so unfavorable, bears further evidence in direct point.

But there can be no doubt that the American iron manufacture is destined to experience a great revival. This will be attended with the certain development of those localities which afford the greatest facilities for conducting this indispensable branch of human industry; and when the revival does come, there is good reason to anticipate that new enterprises will concentrate largely upon or near the Chesapeake and Ohio Railroad, in the vicinity either of

its ore belts or of the coals of the New River and Kanawha valleys, or both.

The iron ore deposits referred to are notable no less for their extent than the diversity and quality of the ores. For a distance of 375 miles along the Chesapeake and Ohio Railroad, there are found in workable seams, at frequently recurring intervals, magnetic and specular ores (as locally termed), the hematites in their usual varieties and fossiliferous, red-shale, slate, block and black-band ores. Many of these ore seams cross the line of the Railroad, and nearly all are cheaply accessible. As will hereinafter appear, these ore deposits are very large, and in some instances are stated by competent judges to exceed in dimensions the seams of the corresponding stratification in Pennsylvania and New Jersey.

The ores in several counties along the Central and Eastern Divisions of the Railroad have long been worked in the charcoal furnaces of the past, and have produced excellent iron, standing successfully the severest ordnance tests and ranking very high in the Government records of gun-metal. Since then, however, the conditions of iron making have greatly changed. Charcoal has ceased to be an economical fuel in the greater part of Virginia, as in many other American districts; and the present low market rates for pig-iron would seem to compel the more general use of the larger coke and coal furnaces with their complete blast machinery and their labor and fuel-saving improvements. Hence the transportation eastwardly, at rates meeting the requirements of economic iron production, of the West Virginia cokes and coals (which are successfully used in the most difficult processes of iron manufacture) becomes the first essential in the iron problem of the future. But the Chesapeake and Ohio Railroad, with its favorable grades, is prepared to supply this want, and is now moving the fuel to the ores, and the ores, with every desired admixture, to the fuel, at rates probably the lowest of any coal and iron railroad in the country. These favorable conditions of ore supply and transportation have caused the leading iron masters of the Ohio valley to send several parties of experts to examine the deposits east of the Blue Ridge, as a substitute for the rich steel (or Bessemer) ores

brought at considerable cost* from Lake Superior and the Missouri iron mountain. These examinations have resulted in favorable reports from the mining chemists and in business orders subject to acceptable rates of transportation.

The first important iron ore belt crosses the Chesapeake and Ohio Railroad in Louisa county, 56 miles from Richmond, with a N. E. and S. W. strike, and can be traced for long distances. It is described as a "fissure vein of hematite iron ore thirty feet wide," by Prof. Ridgway, who adds, "two and a half tons of this ore make a ton of pig-iron." The ore has been mined for many years past near the Victoria furnace (four miles from Tolersville), which, in common with other charcoal furnaces of Virginia, is now suspended under the stress of the times. It is proposed to connect the Victoria works with the Railroad by a branch track, to serve also the gold, copper and sulphuret mines north of Tolersville, which will then permit the iron furnace operations to be resumed with Western fuel and ores for mixture. The Louisa ores tend decidedly to "red-shortness," while beyond the Blue Ridge "cold-short" and neutral ores abound. This suggests an advantageous combination in both directions, which the freight charges of the Chesapeake and Ohio Railroad will profitably allow in any ordinary condition of the iron market.

The next well-defined formation of iron ores is passed immediately beyond Gordonsville. Near this, or Madison, station an excellent hematite (analyzing 57 per cent. metallic iron and 0.10 of phosphorous) has been mined and shipped in quantity. The same formation embraces also micaceous ores with specular and magnetic characteristics. The micaceous ores are mined near North Garden station, beyond Charlottesville, and shipped westward for mixture to the Buffalo Gap furnace. These veins or deposits are traced nearly parallel to the line of the Midland Railroad (to the southwest) beyond James River. In Nelson and Amherst counties the ore exposures become very large, and are described by Prof. J. W.

*Lake Superior and Missouri ores are now delivered to the Ohio River furnaces, between Steubenville and Wheeling, at from $7 80 to $9 00 per 2,240 pounds, according to locality and percentage of ores, which range from 63 to 70 per cent metallic iron.

Mallet (of the University of Virginia) as "an intimate mixture of specular iron and magnetite, a form of specular iron merging into red hematite, and finally limonite or brown hematite." In fourteen analyses, by Prof. Genth, of these ores from the country south of the Chesapeake and Ohio Railroad (and near the line of the James River and Kanawha Canal) the amount of metallic iron was 56, 58, 43, 38, 66, 57, 64, 53, 57, 66, 45, 31, 50 and 58 per cent., the proportions of phosphorus and sulphur shown being very small. It may be added that this ore formation, which is met in workable seams on or near the Chesapeake and Ohio Railroad, in Louisa, Orange and Albemarle counties, is considered by some identical in position with the magnetic ore-belt in New Jersey, from which, in 1867, 115 mines furnished 1,300,000 tons of ore. In Virginia these ores have been imperfectly developed as yet, from the want of cheap and good mineral fuel. This want can be abundantly supplied, as already stated, from the Western Division of the Chesapeake and Ohio Railroad; and with a judicious mixture of the better magnetic ores with selected hematites from Augusta and the counties westward, experts look for a good Bessemer iron.

Limestone for flux is found in Louisa and Albemarle counties, and of a very superior quality west of the Blue Ridge.

Crossing into the Valley of Virginia, the Railroad passes through another group of hematite deposits and considerable masses of what is locally styled "specular ironstone." The hematites are of excellent quality, giving, in several analyses of Prof. J. W. Mallet and Mr. J. B. Britton, from 43 to 58 per cent. metallic iron, with phosphorus ranging in many analyses from 0.14 to 0.24, and in a single instance, reaching 0.52. These ores have been largely mined both for the small charcoal furnaces of the vicinity and for shipment as far east as Richmond. At the Powhatan furnace, near that city, the Augusta hematites, used in combination with Rockbridge hematites and micaceous specular ores from Amherst and Nelson counties, before referred to, have produced, in large quantities, an iron ranked by experts among the strongest and best brands in the American market.

The "specular ironstone" of the Blue Ridge has attracted attention from its entire freedom from phosphorous. The analysis of Prof. Mallet is as follows:

Peroxide of iron	2.64
Sesquioxide of iron	51.33
Alumina	1.73
Magnesia	1.93
Silicic acid, as fine quartz	42.69
Trace of magnetite.	
Metallic iron	37.98

The hematites of this section of the Valley are Silurian, and lie in close proximity to the rich limestones of that series. This deposit is considered by Prof. Ridgway to be "an extension of the same formation as the iron ores of the Cumberland, Reading and Lehigh Valleys" of Pennsylvania.

Rising above the Silurian deposits of the Shenandoah Valley, the line of Railroad next enters the North Mountain belt, one of the most important of the Virginia group, and especially notable for large masses of brown hematite, which have been designated by Prof. W. B. Rogers, from their position and appearance, "Bluff ores." Together with those of the parallel ranges (beyond Mill Mountain, Warm Spring, Richpatch and Peter's Mountains), the North Mountain deposits have been thoroughly examined by some of the leading mining engineers and metallurgists of this country and Europe, who attest their remarkable character for mass, position near the surface and facilities for cheap extraction.

Prof. Ridgway, who devoted some time to the careful examination of these ores, says in his report:

"This Bluff iron ore of the Oriskany sandstones shows itself near to the Buffalo Gap furnace [see Map No. V]; also along the same line of outcroppings, at a point one mile from the Elizabeth Furnace station [see No. VI], where immense cliffs of this ore may be seen; also near Pond Gap station [see No. VII]. Again, in like manner, in the parallel hills at the Esteline furnace [see No. VIII]; and again, at the California furnace [see No. IX], where there is an immense amount of iron ore reposing at a low angle from the horizon, in a stratified form and in good mining

condition. Again, at the Australia [see No. X] and at the Lucy Selina [see No. XI], the beds of ore are of remarkable extent and in vast masses. The aggregate mass of hematite iron ore at these points surpasses anything which I have ever seen elsewhere."

These deposits are traced continuously for miles along the mountain slopes. They lie favorably for excavation and easy removal down to the Railroad, and are mainly mined in open cutting, though occasionally with shafts and drifts. Near the Elizabeth furnace there is presented an ore front of over 1,200 feet, which has been exposed at close intervals and worked irregularly for years with no indications of failure. In some of the larger pits there are vertical breasts of more than 30 feet of ore, with occasional seams or interspaces of clay. The same ore is still met in a tunnel drift 20 feet below the upper excavations, holding quality well as the work descends. The furnace stack (35′×10′ and 3,200 tons annual capacity) is of the oldest style of constructing charcoal furnaces and with corresponding blowing machinery. Under these and other serious drawbacks, the Elizabeth furnace, with its unusual advantages in ore, has been kept in blast until very recently. After the proposed reorganization, it is probable that a new stack, with improved engines, will be commenced during the present season.

In the Esteline, Callie, and other deposits in the same general range, ore excavations have been carried on almost as extensively, and even deeper than at the Elizabeth; being also mined at the same low cost, with the untrained mining labor of the country, and in quality at least equal. Under local conditions so favorable, it is evident that the cost of mining must be low even as compared with the prices of the most favored ore districts.*

In a large number of analyses of the North Mountain ores by our first chemists, the per centage of metallic iron ranges from 40 to 58 per cent. The working average of several furnaces, with unwashed ores, exceeds 40 per cent. for the entire blast: in two instances, an average yield of 50 per cent. is claimed. The analyses

*At the Panther Gap ore banks, (C. & O. R. R.), the contract cost of mining during 1875 was 75 cents per 2,240 lbs.—at the Elizabeth banks, the manager states 65 cents—and still lower prices were given at the Callie furnace.

referred to generally show no sulphur, but phosphorus is present from a trace, up to $0.\frac{85}{100}$ in one extreme case, (the average being under one-half of one per cent.), suggesting advantageous mixtures with the magnetic ores from below as previously stated. At the Longdale (Lucy Selina) furnace, however, excellent iron is made from local ores alone, with judicious combination. At the Buffalo Gap furnaces, (two stacks, 35×9 and $40\times10\frac{1}{2}$, annual capacity 8,000 tons), micaceous ores from Albemarle county are used in mixture with North Mountain hematites. At or very near all the furnace sites named, good limestone for flux is cheaply quarried.

Passing westward, the railroad next crosses the line of occasional deposits of argillaceous hematites in the vicinity of Goshen, Rockbridge county, (168 miles from Richmond), the point of shipment for ores from the large deposits to the southward, locally called the Wilson and Preston, the Gay's Run and the California furnace tracts, upon which are well known and extensive exposures of brown hematite and the other ores of the region.

Three miles beyond Goshen, in the Panther Gap of Mill Mountain, a well defined vein of fossil ore, about eighteen inches in thickness, crosses the railroad near the site of the cold-blast charcoal furnace, (38×9, annual capacity 2,800 tons), built in 1874 to work the local ores. In addition to the hematite ores, the "red-shale" and "block" ores (ferruginous shales and sandstones), yielding 30 per cent. or more of metallic iron, are very generally distributed from the Mill Mountain Westward. The heavy hematite masses, noticed upon the North Mountain, are again found upon the parallel ranges Westward. Among other well-known localities, good outcrops appear on the Cope-Randolph tract west of Millboro': and further on, near the site of the old Australia furnace, on the lands of the Longdale Iron and Coal Company, ores have been mined for many years in large quantity and of excellent quality. On account of these, and other local advantages, well known Pennsylvania iron masters, under that corporate name, have purchased a very large ore property south of Longdale Junction, on the Chesapeake and Ohio Railroad, and have constructed a good branch track seven miles in length to the site of the old Lucy Selina furnace. This furnace has been rebuilt upon

much improved lines, and with good equipment—the new stack being 44×11 in dimensions, and 3,750 tons annual capacity. The fuel, which was formerly charcoal, is now New River coke, brought by rail from the Sewell mines of the Longdale Company in West Virginia. The new furnace went in blast in 1874, and continues to ship one of the best of the Chesapeake and Ohio irons, commanding ready sale in both Eastern and Western markets.

Clifton Forge Gap, 191 miles from Richmond, and the next station beyond Longdale Junction, is the railroad outlet of another iron ore district along the upper James river valley, and of which the Callie furnace (four miles southward) presents the best opened and finest ore exposures. It is through this Clifton Forge Gap that the James River and Kanawha Canal line is located, and through which surveys are now progressing for a railroad connection from Buchanan, the present head of canal navigation, thirty-three miles, with the Chesapeake and Ohio Railroad. This connection, when completed, is expected to become a valuable feeder to the latter, affording a second line of communication with the James River Valley, below Lynchburg, through a series of ore deposits which are destined to draw largely upon the Western division of the Chesapeake and Ohio Railroad for coal and coke.

Clifton Forge is the site of an old forge and charcoal furnace, referred to in the Rogers' State Report, and somewhat noted in the time of batteau navigation for quality of iron. A later organization, entitled the "Raleigh Coal and Iron Company," has commenced here the masonry of a large coke-burning furnace, and is mining ore for the Quinnimont furnace, 103 miles beyond, in Fayette county, West Virginia.

In the Clifton Forge Gap, under heavy sandstone (anteclinal) arches, on either side of Jackson's river, there is presented one of the finest sections of the fossiliferous ore formations scattered through the Alleghany region. The "lump" fossil of these ore bands analyses from 50 to 56 per cent. of metallic iron with the percentages of phosphorus usual in fossil ores. It combines well with the more siliceous hematites westward to make good iron, and especially for foundry uses.

The largest and best organized of the several ore mines referred

to in this region are those of the Lowmoor Iron Company, on the Northern slopes of the Rich-patch range, and 199 miles from Richmond. The prevailing ores of the region are found here in extensive deposits. Of these, the hematites are now worked to meet a special demand, but the fossil seams have also been well opened. One of the larger hematite deposits is described by Mr. Charles E. Dwight, mining chemist, as "a vein of ore from thirty to sixty feet wide, and extending up the hill some 300 feet, and downwards," to depths not now ascertained. At least three considerable, and nearly parallel veins, have been opened up, which do not include other ore deposits, upon the same property, explored or trenched. The Lowmoor Company have made large expenditures to place these mines in thorough working order to anticipate the revival of the iron trade. A branch track, (full guage), two and a half miles long, has been constructed down to the Chesapeake and Ohio Railroad. Crushers and washers, (steam power), of improved plans, discharge ores into the railroad cars, in unusually good condition for furnace use, and for distant shipment. The Lowmoor ores are shipped largely to the Quinnimont furnace westward, and also occasionally to the Ohio river furnaces. At Quinnimont, combined in larger proportion with Clifton ores, the Lowmoor hematites yield excellent foundry and mill iron. Upon and near the Lowmoor tract are several advantageous sites for large blast furnaces, with very good limestone, water supply, and all furnace essentials, save fuel, which must come from New river, 100 miles distant.

The annexed analyses, from two of the Lowmoor deposits, or veins, sufficiently indicate their quality :

No. 5, (*O. Wuth, Analyst*).

Peroxide of Iron, { Metallic Iron, }	59.26
Protoxide of Iron, { 41.48 }	0.00
Phosphoric acid, (Phosphorus, 0.106)	0.38
Alumina	2.75
Lime	1.63
Magnesia	0.76
Manganese	3.46
Sulphur	0.02
Water	9.94
Insoluble Siliceous matter	21.80
3	100.00

No. 4 and Raleigh.

Peroxide of Iron, { Metallic Iron, 53.13 }	75.89
Protoxide of Iron, { }	0.00
Phosphoric acid, (Phosphorus, 0.50)	1.21
Alumina	1,41
Lime	1.04
Magnesia	0.42
Manganese	2.93
Sulphur, (trace)	
Water	9.57
Silicic acid	7.53
	100.00

The ore deposits of the Richpatch Mountain are traced in outcrop, and occasionally opened, far to the southward and westward, both along the James river slopes and upon the spurs (Clarkson's, Carpenter and Horse mountains), leading down to Jackson's river and Potts' creek—especially on the Wilson and Martin tracts, near Covington. Also on the opposite side of Jackson's river, in the foot hills of the Warm Spring mountain, around the Dolly Ann furnace, (now the property of the Longdale Iron Company), and up the slopes of the main Warm Spring mountain, there are extended and important deposits of hematite and fossil ores. Further up the line of the Chesapeake and Ohio Railroad, where it cuts the foot of Peters' mountain, a spur of the main Alleghany, Pittsburg parties have purchased large and valuable ore tracts, with the purpose of building blast furnaces in the vicinity. On Kates' mountain, another spur of the Alleghany, near the White Sulphur Springs, a hematite vein has been opened, analyzing 49 per cent. metallic iron, and clay ores 31 per cent; also, near by, manganese ores. Again, to the North of the White Sulphur, on Anthony's creek, Prof. Ridgway notes "fossiliferous and block ore bands; and the bluff ore of the Oriskany sandstone also shows itself at numerous points in large masses, and is equal in quality to the same class of ores found in Rockbridge county." Surface indications of iron ore continue to be found at intervals on the mountains enclosing the Greenbrier valley, down to its junction with the New river at Hinton, 272 miles from Richmond. This point is the outlet of valuable deposits in Summers, Giles, and adjoining counties, of red and brown hematites and bog and slate

ores, ranging in six analyses from 43.80 to 64.95 per cent. metallic iron, and phosphorus 0.020 to 0.240 of one per cent.; the presence of oxides and specular ores being also reported. A line of railroad connections has been located from Hinton up the New river valley by a Pennsylvania company interested in developing these deposits.*

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*Since the above was written, the following analyses have been received from Thomas Graham, Esq., Vice-President of the New River Railroad Mining and Manufacturing Company, who states they were obtained from ore deposits along the tributaries of New river, in Giles and Pulaski counties:

ANALYSIS.

THOMAS GRAHAM, ESQ.

The sample of Iron Ore from New river, Virginia, which I have analyzed at your request, contains as follows:

Moisture	0.12 per cent.
Silicic Acid	1.83 "
Titanic Acid	none.
Phosphoric Acid	none.
Sulphuric Acid	0.05 per cent.
Magnetic Oxide of Iron	71.36 "
Ferric Oxide	26.52 "
Alumina	trace.
Magnesia	0.07 per cent.
Lime	0.05 "
	100.00
Metallic Iron	70.238 per cent.

[Signed] F. A. GENTH.

University of Pennsylvania, May 3, 1876.

MAGNETIC OXIDES.

Met. Iron.	Phosphorus.	Manganese.	Chemist.
68.90 per cent.	.017 per cent.		Booth & Garrett.
55.69 "	.028 "		" "
69.74 "	none.		Prof. Fesquit.
65.92 "	"		" "

SPECULAR ORE.

62.89 "	trace.		Prof. Fesquit.

RED HEMATITES.

64.34 "	.028 per cent.		Booth & Garrett.
64.95 "	.050 "		" "
68.41 "	.02 "		Prof. Fesquit.

The immense limestone beds of the Greenbrier valley have lately become of interest in this connection—a remarkably pure limestone, analyzing from 90 to 95 per cent. carbonate of lime, and with small percentages of silica and magnesia. It is used at the Quinnimont furnace, Westward, with fifty miles railroad transportation from Fort Spring station, and is destined to bear an important part in the mineral development of this region.

A few miles West of Hinton, the Chesapeake and Ohio Railroad enters the great coal formation of West Virginia. The iron ores of this formation, so far as determined, consist of scattered surface ores: thin seams of ore in place, of which one has been opened on War Ridge, near Quinnimont furnace and the "black-band" deposits of the Kanawha region. The latter have been recently discovered, and are considered important. They lie within convenient access to cheap mineral fuel of the best grades, and being also near excellent building sites, will probably determine the location of extensive iron works in this favored valley.

The Kanawha "black-bands" resemble the noted Scotch ores of the same name, as will be seen from the annexed analysis.*

		BROWN HEMATITES.		
57.80	per cent.	.106 per cent.		Booth & Garrett.
54.96	"	.240 "		" "
58.11	"	trace.		Prof. Fesquit.
56.93	"	.09 per cent.		" "
50.59	"	.026 "		" "
55.13	"	.34 "		" "
48.49	"	.10 "		" "
47.43	"	.229 "	10.01 per cent.	Booth & Garrett.
		FOSSIL, OR CONGLOMERATE ORE.		
50.36	"			Prof. Fesquit.

*The following analysis by Otto Wuth, analyst, Pittsburg, is an average of several made by well known chemists:

Carbonate of Iron	68.35
Carbonaceous Matter	26.02
Silicic Acid	4.64
Phosphoric Acid	0.58
Sulphur	0.42
	100.01
Metallic Iron	33.02

They have been found in well defined veins in several localities near Charleston, and especially upon Davis and Briar creeks. The deposit upon Briar creek is described in the words of a well informed correspondent as follows: "It is nearly six feet thick at the outcrop, and is thought, when fully opened, to be seven feet thick, with rock roof and bottom; and has been traced through several hills over a large territory—say 2,500 to 3,000 acres." The construction of a blast furnace was commenced in West Charleston, not far from these deposits, but has been suspended for an improved iron market.

At Quinnimont station, 294 miles from Richmond, and not far from the Southern border of the New River coal measures, a large furnace (of 12,000 tons annual capacity, with improved engines and hot blast arrangements, and with its own coal mines and coke ovens) has been built to test the question of cheap, good iron from the ores and fluxes eastward, reduced with the cokes of the vicinity—which it will be seen from analyses and results given elsewhere, have proved to be of unusually fine quality for metallurgical uses. Construction was commenced here in 1873—the furnace went in blast during 1874—and it is now in operation, running daily 30 to 35 tons of superior iron, in good demand in the leading markets. For a furnace to continue in blast through the exceptionally low quotations of iron during 1875 and 1876 is well known to mean iron made at low cost.

The Quinnimont enterprise has been prosecuted under greater difficulties than usually attend pioneer operations in a newly developed country. The same company had to explore and to mine, and at the same time to undertake heavy furnace construction and operation. Also, from the panic of 1873, and the commercial depression that followed, it became necessary to defer an important part of the original plan, viz: the completion of a second furnace at the ore mines of the company eastward, to be worked in reciprocal relations with the Quinnimont furnace at the coal, and to that extent reducing the cost of iron production at both. These difficulties overcome, and they are not likely to recur in the same district, better assure the success of enterprises to follow—the degree

of success being measured only by completeness of preparation and close management.

It is the purpose of this paper to present carefully and correctly the facilities for making cheap iron upon the line of the Chesapeake and Ohio Railroad. In dealing therefore with the question of cost, it is preferred to give, in place of general assertions or statements, a few well attested facts, upon which experts can make their own estimates.

During 1875, furnace stock was delivered upon the line of the Chesapeake and Ohio Railroad, in quantity (and generally by contract), for the prices below stated, per ton of 2,240 lbs.—those in 1876 being less in some instances:

1. *Ores.*—For siliceous ores (Blue Ridge specular ironstone), working from 30 to 35 per cent., on cars, per ton, $1 00.

For good unwashed ores, 40 to 45 per cent. (and with right to deduct for bad order), on cars, per ton, $2 00 to $2 08.

For best ores, crushed, washed and well prepared for furnace use, working 45 per cent. and over, on cars, per ton, $2 50.

Two furnace managers, using ores mined within one mile wagon-haul of furnace, give the cost of good, unwashed, 40 to 50 per cent. ores (delivered in stock-house), at less than $1 00 per ton—including all charges save interest.

2. *Limestone.*—For good furnace flux, averaging at least 90 per cent. carbonate of lime, 50 cents per ton delivered on cars. In localities very convenient to the furnace, it has been quarried and delivered in stock-house for less.

3. *Fuel.*—Coal suitable for blast furnace use was delivered on cars during 1875 for $1 40 per ton; in 1876, for $1 20.

Coke running $1\frac{4}{10}$ to $1\frac{7}{10}$ per ton of iron made, was delivered in quantity to furnace stock-house (from ovens about 1,000 yards distant) for $2 50 per ton; afterwards, by contract, for $2 30. The cost of coke in this district is expected to decrease as more coking ovens are built.

4. *Labor.*—Furnace and mining labor along the Chesapeake and Ohio Railroad, did not exceed on average, if at all, $2 97 in 1875, and $2 54 in 1876, per ton of iron made, being the average cost given for anthracite iron in Pennsylvania for the same period. (See table, page 39).

5. *Transportation.*—Freight charges on the Chesapeake and Ohio Railroad, for furnace stock and material, have been, and they are now, less than upon the average of coal and iron railroads.

Experts will see from the data thus given, that the cost of making pig-iron in well selected localities upon the Chesapeake and Ohio Railroad, and with proper preparation, should not exceed $17 per ton of 2,240 lbs., "on furnace bank"—including full allowance for contingencies and interest on working capital.

It should be added, that the officers of at least two furnaces on the line state that their iron is made for less than $17 per ton; also, that well known iron masters from Western Pennsylvania, examining this iron region for investment, have made public their opinion, that when the more perfect furnace plant and the trained labor of the older iron districts come generally into Virginia, pig iron can and will be made for less than $16 per ton.

The importance of these advantages will better appear from a comparison of the cost in the anthracite districts of ore, limestone, fuel and iron, as given in the subjoined tabulated statement* from

* *Average Cost per Ton of Anthracite Pig Iron*, 1860 *to* 1876—*Run of the Furnace—Compiled for the Iron Age, from original data, by Mr. Wm. E. S. Baker, Secretary of the Eastern Iron Masters Association:*

	Cost of Ore to the Ton of Pig Iron.	Cost of Coal per Ton of Pig Iron.	Cost of Lime Stone to the Ton of Pig Iron.	Cost of Labor to the Ton of Pig Iron.	Cost of General Contingencies.	Cost at Furnace Bank.	Add Interest on a Capital on Product of 6,000 Tons.	Total Cost to the Producer.
1860.....	7 45	3 49	1 21	1 87	2 83	16 85	1 36	18 21
1861.....	7 35	3 26	1 17	1 97	2 86	16 61	1 57	18 18
1862.....	7 08	3 68	1 11	1 57	2 67	16 11	1 57	17 68
1863.....	7 49	3 42	1 20	2 07	2 35	16 53	1 40	17 93
1864.....	9 12	5 41	1 93	2 85	1 66	20 97	1 59	22 56
1865.....	13 13	9 66	2 85	4 56	2 01	32 21	1 61	33 82
1866.....	12 19	7 55	2 65	3 46	2 03	27 88	1 64	29 52
1867.....	11 71	7 44	2 76	3 99	1 98	27 88	1 80	29 68
1868.....	10 92	7 11	2 51	3 86	1 90	26 30	1 63	27 93
1869.....	11 86	7 41	2 14	3 46	1 96	26 83	1 71	28 54
1870.....	12 96	7 08	2 44	3 89	3 67	30 04	1 85	31 89
1871.....	12 67	8 59	2 08	3 54	2 77	29 65	1 82	31 47
1872.....	13 64	7 28	2 04	4 69	2 93	30 58	1 75	32 33
1873.....	14 87	7 45	1 98	5 11	3 00	32 41	2 08	34 49
March 1, 1874.....	14 75	7 90	2 03	4 40	2 39	31 47	2 00	33 47
Dec. 31, 1874.....	11 13	7 98	1 66	2 90	2 12	25 79	1 80	27 59
March 1, 1875.....	11 95	8 01	1 14	2 97	2 10	26 17	1 70	27 87
March 1, 1876.....	9 54	6 79	1 01	2 54	1 73	21 61	1 59	23 20

the Iron and Steel Bulletin (May 3), compiled originally for the Iron Age, by Mr. Baker, Secretary of the Eastern Iron Masters Association. It will be observed in this statement, that the average cost of production of anthracite pig iron "on furnace bank," during the year 1875, was $26 17 per ton; and in 1876, $21 61 per ton.

Especial attention has thus been directed to the facility of producing at low cost, upon this line, good iron in its first and most important stage; controlling as it does so many resulting enterprises. Rolling and nail mills, foundries, forges, machine shops, and their associate industries, are soon to follow; and next, upon the full development of the magnetic ore deposits east of the mountains, steel works. Already, in addition to the iron works of the older cities and towns upon the line of the Chesapeake and Ohio Railroad, important improvements have been commenced, and some completed, on the Western division—notably among others, a first class foundry at Huntington, independent of the railroad works there. At intermediate points upon the line there are several localities which offer unusual advantages for iron works on the largest scale, and particularly in the low cost of lands, in abundant water power, proximity to cheap iron and fuel, cheap and very good timber (plain and ornamental), cheap supplies, and a very healthy climate. These advantages can be very much better understood and appreciated after personal examination, for which the usual facilities will be given to parties interested.*

In stating, heretofore, that this extraordinary field of coal and iron production has attracted the careful attention of capitalists and experts, it should have been added that no small proportion of the examinations were made for European investment, and more particularly from Great Britain. Considerable amounts of English capital has been invested in iron and coal lands along the line, and in preparations for mining coal and the manufacture of pig iron.

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*An office for the collection of reliable mineral statistics (with cabinet samples, maps and topographical data) has been opened in the Chesapeake and Ohio depot building, Richmond, Virginia. Full information will be supplied to parties desiring to examine iron and coal properties, or concerning facilities for mining and manufacturing, by application to General W. C. Wickham, Receiver; or to the Consulting Engineer, in the Richmond offices.

Among other well known experts from England, who have visited or personally examined the Chesapeake and Ohio mineral districts, are Prof. D. T. Ansted, Messrs. Lowthian, Bell, Whitwell and Bowron, of the iron and steel interests, W. Clark and Wall, Engineers, and Sir Antonio Brady, F. G. S.

Certain remarks of the latter, before the Glasgow Conservative Association, February 16th, 1875, after his return from the United States, and of interest in this connection, are quoted as follows:

"We have now to compete in the race with other nations (America for instance) on very unequal terms. Nature has been more bountiful to them than to us. Their coal and iron lie on or near the surface, while ours have to be worked from great depths and at enormous cost; and since the opening of the railway I have mentioned, (the Chesapeake and Ohio), these stores of minerals have become easily available.

"Indeed, I know not whether the mineral or the agricultural wealth of the United States is the greater."

COAL.

Authorities agree that the largest carboniferous deposits of the American continent, and in many respects the most important, are the "Great Alleghany," Appalachian or Cumberland coal-fields (as variously designated), extending from Alabama through the intermediate States into Ohio and Pennsylvania. The greatest ascertained development of these deposits is found in the State of West Virginia, where the surface area was estimated by Professor Wm. B. Rogers, of the Virginia Geological Survey, to cover 16,000 square miles. These coal measures are here quite as remarkable for their depth in vertical section, their variety and excellent quality, as for their vast extent. West Virginia cokes and coals are well known to be in special demand for all uses to which mineral fuel can be applied in domestic uses, in metallurgy, and the arts generally. In combination with the iron ores eastward, these immense beds of coal mark the future site of one of the largest manufacturing districts of the United States.

The Chesapeake and Ohio Railroad (passing the older or "false" measures of Augusta county, near Buffalo Gap furnace, and the

carbonaceous shales with one coal seam of two inches thickness in the Lewis tunnel) enters the Alleghany coal-field proper near the junction of New river and Meadow creek, a few miles beyond Hinton—the first outcrop being met on the slopes of Bluestone river, four miles to the Southwest. Thence down the New river and Kanawha valleys, the several seams referred to are traced continuously upon either slope to the vicinity of Coalsmouth, or St. Albans, 108 miles west of Hinton. Beyond St. Albans, for 48 miles to the Kentucky State line, the railroad skirts the Northern border of the Coal river, Guyandotte and Big Sandy coal-fields, for which, by branch tracks, it is the only outlet by rail.

In addition to the mining facilities thus afforded by a frontage of over 100 miles of main track, through the richest and deepest portion of the New river and Kanawha districts, the tributary valleys, including the Gauley and Elk river basins, supply lines of interior access, aggregating at least 400 miles, upon which good branch tracks may be constructed at moderate cost. The slopes and side drainage are also favorable for coal inclines and for the steep mining tracks successfully used in the anthracite districts of Pennsylvania.

Mr. Howell Fisher, of Pennsylvania, in 1873, wrote as follows:

"In respect to conditions most essential to cheap and profitable working, this region stands unrivalled. It has been stated before that the chasm of the river renders it most peculiar service in its relation to the coal. Cutting all the coal strata for nearly its whole length entirely through, and getting down among the shales under the coal, the river has caused the numerous streams which pierce this whole coal region to cut down through most of the coal-bearing strata on their courses, leaving the coal entirely above water level, accessible at hundreds of points by simply scraping off the surface soil; so that so far as the mere getting of coal is concerned, two thousand dollars will open a mine ready to ship one thousand tons per week. There is no region in the world where less physical labor will prepare a mine for the delivery of coal at the drift's mouth.

"This will be made clearer by a comparison of the position of coal here and in Great Britain in this respect. In Great Britain, and in fact in most all of the European coal-fields, the coal is deep below the water-level. To reach the seams requires the expenditure of years of labor and vast sums of money in sinking shafts or pits, and in erecting pumping and hoisting machinery, to be maintained and renewod at heavy annual expense. It is authoritatively stated, that the cost of sinking shafts in the Newcastle region

of England to the depth of one thousand feet, has been, in many instances, one thousand dollars per yard. In the great Northern coal-field of Great Britain, producing twenty millions tons per annum, there are two hundred pits or shafts, costing, in first outlay, for sinking and machinery, fifty millions of dollars, to which must be added the necessary expense of constructing and maintaining proper air-courses and their accessories requisite to the safety of the employés.

"There is now invested simply in pits, and machinery for pumping and hoisting the one hundred million tons produced in Great Britain, two hundred million dollars; and this vast sum is destined to utter destruction in serving the purposes for which it was used.

"These pits and machinery being constructed, they involve a certain amount of labor for every ton of coal got, in addition to their cost and renewal.

"Now, in this great coal-field crossed by the *Chesapeake and Ohio Railroad*, Nature has already sunk all the necessary pits and shafts, which need neither repair, renewal, or labor to work them. The laws of gravity have provided the most perfect, permanent, and costless pumping machinery; and the most perfect ventilation of the mine and safety of the employés, instead of requiring scientific knowledge and anxious thought, is simply a matter of the most ordinary care, the almost perfect freedom from noxious gases being the natural result of the position of the coal strata."

Three years' working experience has intervened, under adverse conditions of markets and mining labor, to test the sanguine views of Mr. Fisher.

The number of mines has increased from two, which commenced coal shipments by rail in 1873, to eighteen in 1876, not including those mines on the far bank of the Kanawha river, which have been compelled to ship by water. One of the largest and most prosperous, (at Cannelton), however, now uses rail transportation altogether, having good ferry arrangements over the Kanawha. With this increase of mines, the coal tonnage has steadily increased—that of 1875 being 35 per cent. over 1874, and in 1876 (first five months) about 50 per cent. over the same period of 1875.

Of the eighteen mines referred to on the Chesapeake and Ohio Railroad, not one has been found to require machinery for ventilation, hoisting or pumping; and there has been an unusual exemption from mine accidents. Their mining plant is of the simplest character, viz: side or branch tracks, inclines and tipples, and occasionally bins. The facilities in this valley for opening work at low cost are certainly exceptional.

At least three of the smaller mines have been opened, the officers of the railroad report, for less than $2,000, "so far as the mere getting of coal is concerned."

But for greater precision of statement, reference is made to the Coal Valley mine, (343 miles from Richmond), which weekly ships 960 to 1,000 tons from a seven foot vein, here 80 feet above the railroad. The agent of this company states that the original outlay to open and equip the mine was $4,200, and that the entire expenditure to date, including all mining work chargeable to this account, and for all fixtures, rails, tools, cars and stocks, has been $6,230. This Coal Valley enterprise, one of the most successful of the Kanawha Valley, is operated on leased ground, under royalty, by an association of miners, and has supplied the Richmond Gas Works by contract during 1875 and 1876—also shipping gas coal to more distant points.

Other mines have been opened upon the Coal Valley and adjoining seams for less cost where they approach the railroad more closely. The smaller mines are generally operated by miners on lease, and when examined present the most convincing evidence of the facility of mining superior coals at very low cost. It is emphatically the field of work for men, or companies, of small means.

In referring more particularly to these coals, the New river group of the lower measures comes first in geological order; although from the N. W. dip of the formation they are the higher, topographically. For information in detail upon the geological features of this region, reference is made to the writings of Rogers, Ansted, Stevenson, Hildreth and MacFarlane, and to the recent report of M. F. Maury to the State Centennial Commission, upon the mineral resources of West Virginia.

The Quinnimont coal section on Laurel creek, of New river, shows the outcrop of eight well defined seams, aggregating about twenty-one feet of coal. These seams appear to thicken as they leave New river. Four miles up Laurel creek, the four feet seam mined at Quinnimont becomes five feet and over in several openings. Also, opposite, on the Raleigh slopes, a six feet vein is mentioned in the State Report, (Maury).

At Sewell Station, 313 miles from Richmond, the same authority

gives a section of eight seams, with twenty-two feet total thickness of coal; and at the Hawks' Nest, 324 miles from Richmond, seven seams, with forty-four feet total thickness.

The "lower," or New river measures, yield several superior steam coals, the Nutall mine now supplying the Old Dominion line of steamers from Richmond to New York, and the other mines a large portion of the demand for the James river and Richmond city. These coals have also very valuable coking properties, as will be seen from the annexed analyses, compiled from mine records and the State Report:

COALS.

MINE.	Carbon.	Volatile Matter.	Ash.	Sulphur.	Water.	Hydrogen.	Oxygen.	Nitrogen.	CHEMIST.
Nutallburg	69.00	29.59	1.07(?)	0.78	0.34	....	....	....	C. E. Dwight.
Sewell	72.32	21.38	5.07	0.20	1.03	....	....	....	J. B. Britton.
Quinnimont	75.89	18.19	4.68	0.30	0.94	....	....	....	J. B. Britton.
New River Coal and Coke Co.	71.33	22.53	4.33	....	1.81	....	....	....	J. B. Britton.

COKES.

Nutallburg	91.22	.....	7.53	0.92	....	....	....	....	C. E. Dwight.
Sewell	93.00	.....	6.73	0.27	....	....	....	....	J. B. Britton.
Quinnimont No. 1	93.85	.....	5.85	0.30	....	....	....	....	J. B. Britton.
Quinnimont No. 2	91.72	2.71	5.09	0.48	....	....	....	....	J. B. Britton.
Quinnimont No. 3	91.14	.....	6.65	0.42	0.23	0.38	1.17	0.01	J. W. Mallett.
Connellsville	87.46	.....	11.36	0.69	0.49	....	....	....	J. B. Britton.

The New river cokes are ranked first class for blast furnace and cupola use. They have supplied the Quinnimont, Longdale, Callie, Elizabeth and Buffalo Gap furnaces, and the more important foundries on the line of the Chesapeake and Ohio Railroad. In blast furnaces, 1½ tons of this coke is the usual allowance for one ton of iron made from raw ores; and one case has been reliably reported, where, with prepared ores, the lower English

figures have been held. In cupola work, the Ensign Manufacturing Company (Huntington) reports for car-wheel casting as follows:

"The coke sent from Quinnimont for trial has proved successful and fully equal to the Connelsville coke we have been using. We melted a heat of five tons, carrying a charge of one (coke) to nine (iron) in fifty minutes, giving the metal very hot, and as fast as eight moulders could take it away."

Similar results are reported in Richmond and in other foundries upon the line.

In the New river district, mining work was commenced in 1873. There are now four mines in operation, and a fifth is preparing to ship.

The Quinnimont mines, 295 miles from Richmond, are chiefly worked to supply the large iron furnace near by with its complement of eighty coke ovens, but shipments of coal are also made for the Eastern markets.

The New River Coal and Coke Company has recently opened upon the same vein, 13 miles westward, for coal, and eventually for coke shipments. Their seam is here 4½ to 5 feet thick.

The Longdale Coal and Iron Company work the Sewell mine, 312 miles from Richmond, (in the upper vein of 3½ to 4½ feet thickness), and exclusively for their "Lucy Selina" furnace, in Alleghany county, Virginia. The coke-oven arrangements here, and their product, are among the very best of the district.

The Nutall Company, four miles westward, has also commenced the construction of coke-ovens, but its operations are at present more directed to coal shipments. The Nutall coke is excellent, and was used for several months in the Callie furnace, Botetourt county, Virginia. It has also proved a first class fuel in the Huntington car-wheel foundry.

On the Gauley mountain, there is the first marked transition from the New river to the Kanawha series. The Gauley-Kanawha Company has opened for mining the large 11 feet seam on that mountain, three miles from Hawks' Nest station, and has constructed a good narrow-gauge railroad down the slopes of Mill Run. Cannel coal and black-band ores are also reported on their

Gauley tract. The State Report gives the following analyses (from the Royal School of Mines, London), for coal from the 11-feet seam :

Coke	65.99	Ash	2.15 per cent.
Volatile matter	32.62	Sulphur	0.74 " "
Water	1.40		
	100.00		

Volatile gas per ton (2,240 lbs.), 10,100 cubic feet—$17\frac{8}{10}$ candle power.

The State report describes the New river coals, in general terms, as "friable, rich, bituminous, exceedingly pure, and the seams have the advantage of being very free from partings."

The Kanawha coals differ from the New river in several important characteristics. They are harder, have less fixed carbon, more volatile combustible matter, generally less ash; and in variety they meet a somewhat wider range in the requirements of the mechanical arts. In the brief period since the completion of the Chesapeake and Ohio Railroad, the best grades of cannel, semi-cannel, splint, block and gas coals, (as known to commerce), have been introduced into and are shipped, in quantity and regularly, to both Eastern and Western markets.

The extent and thickness of the Kanawha seams are considered remarkable by geologists and mining engineers, even as compared with the most noted of the Alleghany coal-fields.*

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*The work "Coal, Iron and Oil," by Daddow & Bannon, Philadelphia, edition of 1866, page 340, speaking of this coal basin, says: "Coal river, Elk river, and Gauley diverge from the Great Kanawha and spread their branches over one of the *richest* and most *magnificent coal regions* in the world, and bring down their wealth to one common centre on the Great Kanawha. The coals of this region generally are *better*, *purer*, and *more available* for all the requirements of trade and manufacture than the coal from any other portion of the Alleghany coal-field. The seams of coal are more numerous and their thickness greater than in any other portion of this coal-field; it can be *mined cheaper* and with more economy generally, under the same rates of labor, *than in any other region in this country without exception.*

In the State Report, (Maury), which evidently seeks not to overstate, there are given three sections of the coal strata at different localities in the Kanawha valley, as follows, viz:

At Cannelton, 38 feet 6 inches thickness of coal, (with partings), "partial above water level."

At Paint creek, 38 feet 10 inches thickness of coal, (with partings), complete above water level.

Near Coalburg, 41 feet 3 inches thickness of coal, (with partings), complete above water level.

As in the New river measures, these seams become thicker as they recede from the Kanawha.

The Ridgway section at Cannelton, (1873), gave five workable seams there opened, with 29 feet of coal exposed, and an aggregate thickness in section of 41 feet. Professor Ridgway adds: "The lower coal measures which I have just described, (Kanawha, &c.), are comprised in twenty-four seams, eleven of which—containing an *aggregate thickness of fifty-one feet*—are workable. The pick and shovel may disclose new beds in addition." His estimate of the quantity of coal within five miles only on either side of the Chesapeake and Ohio Railroad, above water level, is very large.

The Ansted section for Amstrong, Paint and Cabin creeks, gives fifteen exposed seams, with an aggregate thickness of 66 feet. Professor Ansted is quoted at length further on.

Major Hotchkiss gives larger figures for the Cannelton section; probably estimating for coal seams under water level.

Such, however, is the well known wealth in coal of the Kanawha district, that it is unnecessary to dwell further upon particular sections, estimates or measurements. The practical question of the future, as demonstrated during the brief mining experience upon the Chesapeake and Ohio Railroad, since its opening in June, 1873, is simply one of development, more or less rapid as affected by the revival of the coal and iron trade.

The superior qualities of the Kanawha coals are sufficiently indicated in their analyses, of which the following are compiled for the leading mines, from the most reliable authorities at present accessible—adding for comparison those of a few of the standard

coals of Great Britain and of West Pennsylvania, Ohio, and other States:

LOCATION.	Volatile Matter.	Fixed Carbon.	Ash.	Water.	CHEMIST OR AUTHORITY.
Cannel Coals:					
Peytona, West Virginia	46.00	41.00	13.00	.....	Manhattan Gas L. Co. and Professor Chandler.
*Cannelton "Selected," W. Va.	46.50	43.20	10.20	.....	C. M. Cresson.
do. "Average," "	46.50	41.30	12.20	.....	C. M. Cresson.
Darlington, Ohio	43.00	40.00	17.00	.....	Chandler.
Kirkless Hall, England	40.30	56.40	3.30	.....	Chandler.
Semi-Cannel, Coking and Gas Coals:					
Cannelton, West Virginia	35.10	62.90	2.00	.....	Ford.
Coal Valley "Lower Seam," W. Va.	35.20	61.60	1.87	1.53	State Report.
Coalburg "Main Seam," "	40.50	56.50	1.50	2.00	Levette.
Raymond City, West Virginia	33.00	60.10	6.90	.....	Vinton.
Despard, "	40.00	53.30	6.70	.....	Chandler.
Sterling, Ohio	37.50	56.90	5.60	.....	Chandler.
Pittsburgh, Pennsylvania	36.76	56.17	7.07	.....	Chandler.
do. do.	41.10	56.90	1.00	1.00	Levette.
Westmoreland, do.	36.00	58.00	6.00	.....	Chandler.
Penn'a Gas Co. do.	35.80	61.00	3.20	.....	Cresson.
Lingan, Cape Breton	35.20	60.80	4.00	.....	Chandler.
Block House, Cape Breton	40.80	57.70	1.50	.....	Chandler.
Newcastle, England	32.70	65.55	1.75	.....	Chandler.
Splint and Bituminous Coals:					
Paint Creek "Gray Splint," W. Va.	30.13	63.74	6.13	.....	Doremus.
Coal Valley "Top Seam," "	38.32	57.20	4 30	0.18	Richmond City Gas Co.
Gauley, Kanawha, "	30.00	65.00	4.50	.....	Manhattan G. L. Co.
Coalburg "Splint," "	32.50	62.00	1.50	4.00	Levette.
do. "4 ft. Seam," "	33.26	62.61	1.81	2.32	Riverside Iron Co.
Campbell's Creek, "	35.64	61.07	1.41	1.88	Riverside Iron Co.
do. "2d Seam," "	32.24	64.16	3.60	.....	Rogers.
do. "3d Seam," "	33.68	57.76	8.56	.....	Rogers.
Kelly's Creek, "	37.08	60.92	2.00	.....	Rogers.
Winifrede, "	27.01	68.53	3.22	1.24	Locke, Cinn.
Youghiogheny, Ohio	28.10	66.69	3.44	1.77	Locke, Cinn.
Pomeroy, "	35.80	47.72	12.99	3.49	Locke, Cinn.
Canton, "	34.50	59.50	6.00	.....	Warmley.
Star Mine, Indiana	32 50	61.50	2.50	3.50	Levette.
Clyde Splint, Scotland	36.80	59.00	4.20	.....	Mushet.
Enriching Materials:					
Grahamite, West Virginia	53.50	44.50	2.00	.....	Chandler.
Albertite, Nova Scotia	57.70	41.90	0.40	.....	Chandler.
Boghead Mineral, Scotland	51.60	15.70	32.70	.....	Chandler.
Hartley Mineral, Australia	82.50	6.50	11.00	.....	Chandler.

*The following analysis of the lower stratum of the Cannelton Cannel vein appears in a recent publication of that company:

Fixed Carbon	23.5
Volatile Matter	58.0
Ash	18.5

SPLINT COALS.

Nearly all of the Kanawha mining properties have one or more veins of splint or block coal, of which the distinctive features are

"square, regular cleavage and great purity," as appears from the low percentage of ash in the foregoing analyses.

The State Report (Maury) refers to the splint coal as follows:

"In the Kanawha region it is abundant, and, in admixture with more or less bituminous coal, is found in seams as thick as 10 and 11 feet. For the combined purposes of steam, domestic use, and the manufacture of iron, it may be looked upon as the most useful and valuable coal of the State, and even now it ranks so high that in the New York retail market it quotes higher than any other West Virginia coal, except cannel. Its value is due to its firmness and solidity, which enables it to be handled, shifted and stored with very little loss. It burns well, leaving but little ash; has both high calorific power and intensity; is usually remarkably free from sulphur and other impurities; has little or no tendency to clinker; is *free from the danger of firing by spontaneous combustion—a great desideratum in storage, and ocean transportation;* is first rate as a steam and household fire, and it has particular adaptability in its raw state to the manufacture of iron in the blast furnace, for which purpose it is eagerly sought in districts accessible to market, as it makes a quality of iron which can only be surpassed by the use of charcoal."

The great sustaining strength of splint coal becomes a very important consideration with the increasing dimensions of blast furnaces. In the United States these stacks have already attained the height of 86 feet, and still greater heights in Europe, requiring the strongest and best furnace fuel to support the "burthen" of ore and limestone. In one of the highest of these furnace stacks, (Ætna, Ironton, Ohio,) the Campbell's Creek, (Kanawha), splint is used half and half in combination with coke; also in the Bellefonte and other Ohio River furnaces with a much higher percentage of splint coal. The Ashland furnace, on the Kentucky side of the Big Sandy, using for fuel only the coals of the vicinity, make Bessemer iron from Missouri and local ores. Both Coalburg and Campbell's Creek Splint have been used without mixture in blast furnaces, and in two instances on the Chesapeake and Ohio Railroad, in combination with charcoal. The question of practicability

has passed into one of relative economy, as compared with coke, varying with local conditions and cost of transportation.

The Kanawha Splint coals are also in favor for heating and puddling furnaces. Fine coal from several mines (the Straughan and Coal Valley, among others,) is transported 337 miles to the iron works of Richmond, Virginia, and the Kanawha coals generally to the rolling mills westward.

GAS COAL.

Cannel—The name (Cannel—Candle) sufficiently indicates the more valuable properties of this mineral. The high percentage of "volatile (gaseous) combustible matter," shown in the analyses, also explains its precedence and high price among gas coals in the eastern markets. And this precedence appears more plainly in comparing—say the Peytona Cannel yield of 13,200 cubic feet of gas, 42.79 candle power, with the average of about 10,000 cubic feet of 16 candle power for the standard gas coals of commerce. Hence the demand for cannel coal in leading gas works, as an "enricher."

The cannel coals are found in probably larger workable quantities in West Virginia than in other localities on the American continent. The Peytona mine has shipped largely and almost continuously since the opening of the Chesapeake and Ohio Railroad, using for the present the westerly outlet, Coal River with its slack water navigation of 30 miles to St. Albans (Coalsmouth), and transhipping there to the railroad for eastern markets. Surveys have been made for a branch railroad connection (of about 12 miles across the intervening ridge) with the Chesapeake and Ohio Railroad at or near Brownstown Station. This accomplished, will greatly increase the shipping capacity of these valuable mines, and afford access to other cannel properties in the Coal River district. The Peytona Cannel vein ranges from 2 feet 6 inches to 4 feet in thickness.

The Cannelton Company (across the Kanawha River from Cannelton Station, 343 miles from Richmond,) also ships cannel largely in addition to working other seams upon the same property, viz:

No. 4. Cannel, ranging from 1 to 5 feet in thickness, with a softer or semi-cannel on top.

No. 5. Block or Splint coal, about 8 feet thick, hard, strong, and with other characteristics of the better splint varieties as described elsewhere.

No. 2. Coking or Gas Coal, 7 feet thick, and conforming in position to the vein on the westerly slopes of the Kanawha described as Coal Valley.

Capacity of the Cannelton mines 300 tons daily, with very complete equipment and shipping arrangements.

The valuable Cannel seams of the Cannelton section, together with other veins, have been opened at several points upon the Huntington property adjoining, and elsewhere in the vicinity. While the Kanawha coal formation is unusually reliable in the continuity of its seams and freedom from serious faults, it is the characteristic of Cannel seams generally elsewhere to run out suddenly or change into bituminous or other varieties in the same seam. This well known peculiarity of Cannel deposits renders the more important and valuable those of the Kanawha group in their greater extent and vein thickness, so far as developed, although it is not to be understood that even these deposits are entire exceptions to the uncertainty of Cannel formations elsewhere.

Upon the slopes of Paint Creek, below and opposite, there are rich cannel deposits, some of which were worked for oil before the general opening of petroleum wells. This was also done at Cannelton, the yield being 2 gallons per bushel, or 56 gallons per ton There are several well ascertained cannel deposits within a circuit of some 20 miles radius from Paint Creek Station, and others at more distant points upon which information is less positive.

Cannel and bituminous shales are also found in large quantities in this formation.

Semi-Cannel, Coking and Bituminous Coals—Under these designations are included most of the gas coals of commerce. It will be seen from the annexed tabular statement, which contains also several of the standard gas coals in Great Britain and the United States, that the Kanawha coals compare favorably with the best, and give decidedly superior results to most on the list:

LOCATION.	Cubic ft. of Gas per ton of Coal.	Value in lbs. of Spermaceti candles.	Candle Power.	CHEMIST OR AUTHORITY.
Peytona "Cannel," Kanawha.....	13,200	.....	42.79	Manhattan Gas Light Co.
Cannelton " Kanawha...	12,025	.....	45.60	Manhattan Gas Light Co.
	10,000	.....	64.54	
" "Average," Kanawha.....	11,648	950.6	.....	C. M. Cresson.
" "Selected," Kanawha.....	12,588	992.7	.....	C. M. Cresson.
" "Coking," Kanawha.....	11,334	.....	16.14	Ford.
Coal Valley "Lower Seam," Kanawha	10,080	.....	17.0	Richmond Gas Works.
Blacksburg..... "	10,304	.....	17.0	Richmond Gas Works.
	10,752	.....	16.0	Metropolitan Gas Light Co.
Coalburg..... "	10,707	.....	17.8	South Boston Gas Light Co.
" ..... "	11,244	.....	16.9	Brookline, Mass.
*Coal Valley..... "	11,771	.....	17.0	Waltham Gas Co., Mass.
Despard, West Virginia.....	10,765	.....	20.41	Chandler.
(Quantity of coal used in trial not known.)				
Westmoreland, Pennsylvania.....	10,642	.....	16.62	Chandler.
Penn'a Gas Co., "	9,856	473.00	.....	Cresson.
Sterling, Ohio.....	10,523	.....	18.81	Chandler.
Boghead, Scotland.....	15,426	2755.60	.....	Fyfe.
Newcastle, England.....	10,057	.....	10.11	
Lingan, Cape Breton.....	9,520	.....	12.92	Chandler.
Block House, Cape Breton.....	10,217	.....	17.32	Chandler.

*The Kanawha tests, as above quoted, were from various quantities of coal, ranging from 10 tons up to the working average, in one case, of 5,000 tons.

ERRATA.

After note on "Kanawha Tests," read the first six paragraphs on page 57.

Page 54, fourteenth line from top, read 34 to 44 inches.

Page 25, fourteenth line from top, read "and was completed."

veins opened—two worked. The "Coalburg," 7 feet seam, supplies one of the best splint coals known, and is in special demand for engine* fuel, iron works, and household uses. Present capacity daily, 350 to 400 tons.

Houston mine, 2 miles west; two openings, splint and gas; the latter about 3 feet thick, and partially cannel; vein 60 feet above railroad. Work suspended for the present.

*Mr. Buck, M. E., gives the average engine consumption of Coalburg coal used on the Kentucky Central Railroad, for six months during 1875, at 30 pounds per mile of train moved, and the following monthly averages: March, $32\frac{8}{10}$ pounds per mile run; April, $31\frac{4}{10}$; May, $30\frac{4}{10}$; June, 25, and July, $27\frac{6}{10}$. The engine performance with Youghiogheny coal upon the same railroad was not equal to the Coalburg, according to figures from same authority.

Coalmont mine, near Lewiston, and probably in the Lewiston vein, which is 370 feet above the railroad; ships good splint coal, with equipment for 200 tons when in full operation. Gas coal vein also opened.

Lewiston Company, 356 miles from Richmond; two openings in splint veins, 4½ to 7 feet thick, and two additional in gas coal veins. The Lewiston is one of the best Kanawha splints, and is shipped to New York and other distant points. A working test of this coal for passenger engine* service on the Atlantic, Mississippi and Ohio Railroad, is given below. Daily capacity of Lewiston mine, 450 tons.

Brownstown, 360 miles from Richmond. The English cannel vein, one mile distant, and 480 feet vertically above the railroad, has been opened with good promise, the vein showing 34 inches in outcrop. A branch track to this seam has been located, and will be constructed during the present season.

Nearly all the Kanawha coals thus mentioned, have been, or are now used, for the Chesapeake and Ohio engine service. The working results for the year 1875, are given in the following abstract from the regular reports of the machinery department:

TRAIN SERVICE.	Maximum weight of Engines and Tenders used.	Average weight of Trains.	Mileage during 1875.	Pounds of coal used per mile run.		REMARKS.
				Best monthly average.	General average, wastage included	
	Lbs.	Lbs.				The general average for the year includes in 'wastage' the deterioration of coal in stock and all losses whatsoever.
Passenger and mixed..	90,000	220,700	521,814	29.62	37.0	
Freight.....	120,000	887,000	1,127,350	52.44	62.5	
Road.....	111,500	324,000	106,069	.....	40.3	

*Memorandum of trial of Lewiston coal upon the Atlantic, Mississippi and Ohio Railroad, from notes of Mr. Henry Fink, Superintendent of Transportation:

Weight of engine and tender loaded..... 110,300 pounds.
Weight of train West, 6 cars, exclusive of engine... 273,250 "
Weight of train East, 5 cars, exclusive of engine... 214,000 "
Sum of ascents West, (Lynchburg to Bristol)..... 4,815 feet.
Sum of descents West, (Lynchburg to Bristol)..... 3,755 "
Maximum grade, 70 feet per mile.
Maximum curve, 7 degrees.
Coal consumed per round trip of 408 miles, 29.02 pounds per mile run.

These working averages are found to compare very favorably with the performance sheets of all railroads examined by the writer. As this large item of expenditure is now receiving much attention in railroad administration, and particularly from companies buying "outside" fuel, a comparative statement of engine performanee with the coals of two well known districts, (under somewhat similar conditions of service), is given below for the benefit of parties interested:

FROM STATE CENTENNIAL REPORT—PAGE 222.

BALTIMORE AND OHIO RAILROAD,

Office of Chief Engineer, Martinsburg, W. Va., April 6, 1876.

M. F. MAURY, ESQ.:

Dear Sir—I give you results of observation on the consumption of fuel in locomotives on this road:

1st Division, Baltimore to Martinsburg	100	miles.
Weight of engine	72,900	pounds.
Weight of train	834,000	"
Maximum grade (per mile)	80	feet.
Minimum radius of curvature	600	"
Ascent westward	1,282	"
" eastward	913	"
Consumption of coal per mile run	60	pounds.

Coal was from large vein near Piedmont, in Mineral county.

3d Division, trip from Keyser to Grafton and return	157½	miles.
Weight of engine	95,300	pounds.
Weight of train	831,000	"
Maximum grade (per mile)	117	feet.
Minimum radius of curvature	600	"
Ascent westward	2,518	"
" eastward	2,334	"
Consumption of fuel per mile run	134	pounds.

Coal was from large vein near Piedmont, in Mineral county.

4th Division, Grafton to Benwood	95¼	miles.
Weight of engine	73,400	pounds.
Weight of train	795,000	"
Maximum grade (per mile)	68	feet.
Minimum radius of curvature	600	"
Ascent westward	825	"
Ascent eastward	1,167	"
Consumption of fuel per mile run	90	pounds.

Coal was from the mines at Fairmont, in Marion county.

Parkersburg Branch, Parkersburg to Grafton	104	miles.
Weight of engine	73,400	pounds.
Weight of train	600,000	"
Maximum grade (per mile)	52.8	feet.
Minimum radius of curvature	600	"
Ascent westward	1,644	"
Ascent eastward	2,086	"
Consumption of fuel per mile run	85	pounds.

Coal was from the mines at Clarksburg, in Harrison county.

Respectfully,

(Signed) JAMES L. RANDOLPH, *Chief Engineer.*

CHESAPEAKE AND OHIO RAILROAD,
Office of Engineer and Superintendent of Transportation,
Richmond, Va., May 1, 1876.

ENGINE PERFORMANCE FOR FUEL.

FREIGHT SERVICE.

Eastern Division, Richmond to Staunton	136.38	miles.
Weight of engine ..... 61,500 pounds	70,250	pounds.
Weight of train ..... 754,800 "	943,500	"
Maximum grade (per mile)	75	feet.
Minimum radius of curvature	716	"
Ascent westward	3,163.02	"
Ascent eastward	1,805.87	"
Consumption of coal per mile run, as determined by the monthly average reports of the master of machinery	54.68	pounds.
Middle Division, Staunton to Hinton	136.31	miles.
Weight of engine ..... 61,500 pounds	70,250	pounds.
Weight of train ..... 435,140 "	586,100	"
Maximum grade (per mile)	80	feet.
Minimum radius of curvature	716	"
Ascent westward	2,520.32	"
Ascent eastward	2,530.50	"
Consumption of coal per mile run, as determined by the monthly average reports of the Master of machinery	57.42	pounds.
Western Division, Hinton to Huntington	148.34	miles.
Weight of engine ..... 61,500 pounds	70.250	pounds.
Weight of train ..... 943,500 "	1,132,200	"
Maximum grade (per mile)	30	feet.
Minimum radius of curvature	716.8	"
Ascent westward	379.85	"
Ascent eastward	1190.35	"
Consumption of coal per mile run, as determined by the monthly average reports of the master of machinery	55.96	pounds.

(Signed) W. M. S. DUNN,
Engineer and Superintendent of Transportation.

The gas and splint coals referred to are mined by nearly all of the Kanawha Companies heretofore noticed. In addition, there are the following:

Straughan mine, half mile west of Coal Valley, and upon the same vein; height above railroad track, 70 feet; present daily capacity, 100 tons, with shipments 50 to 60.

Lewis and Love, Upper Creek, 2 miles west, in a 6 feet vein, 35 feet above track level; shipping good splint and gas coals; present daily capacity, 200 tons.

Paint Creek, Gordon and Seal, three seams opened, two being splint, (black and grey), and one of approved gas coal; 200 tons daily capacity.

Kanawha Semi-Cannel Coal Company, 349 miles from Richmond. Several openings, but working the 7 feet grey splint vein, one of the hardest and strongest of the Kanawha coals, and prized for family fuel. Present capacity 130 to 150 tons, which, in view of the substantial incline track and equipment of the mine, could be rapidly and largely increased.

Blacksburg mine, 2 miles west, and directly upon railroad. Vein 3½ to 4 feet thick, without partings, and one of the richest and best gas coals in the market, having been shipped in quantity to gas works in Boston, New York, Washington, Richmond and Cuba. Present daily capacity 100 tons, and mining facilities being increased.

It has been stated that considerable investments of English capital have been made in coal lands upon or near the line of the Chesapeake and Ohio railroad.

The Gauley-Kanawha Coal Company (limited), one of the largest of these enterprises, has opened mines on Gauley mountain, as heretofore mentioned; built branch tracks, and made other improvements, under well understood difficulties, topographical and otherwise. The experience of this company (of the greater interest on that account) is indicated in the following remarks of W. Clark, Esq., (Mem. Inst. C. E. and sent out from England to inspect and advise,) in presenting his report to the meeting of stockholders in London, January 15, 1876. Mr. Clark said:

The report which has now been read was written with a desire to convey to the minds of those who are interested the simple facts of the case, that they may be able to judge for themselves the position of the undertaking. I have carefully avoided giving any coloring whatever to these facts, though it is almost impossible to say too much of the property as a coal-producing locality. I believe that when the company is in a position to place coal in the market, they will be able to effect sales at remunerative rates. The quantity will probably not be great at first, and the business must be pushed by degrees. My estimate has been formed on an output of 300 tons per day. When that quantity is sold daily, and I believe it soon will be, I think all the shareholders may look for ten per cent. on their investment. There will, however, be the usual difficulty of putting a new coal into the market; this will involve some expense and time. There must also be a working capital. The amount necessary for this will depend on the contract made, and whether the buyer or the seller pays freight; in the latter case it will be considerable. Prompt payments for labor are of course necessary. The railways and shipowners give no credit whatever. I find that I have omitted to state that the one engine (narrow-gauge locomotive) will be capable of working 400 tons per day over the hill, and with a second engine 800 tons. There is one subject I have not alluded to in the report—that is the store. This I found to be a very flourishing concern. It was started in April, 1874, with a capital of $959. Besides paying the current expenses, it has now a stock worth $2,193, or it has more than doubled its capital.

Some persons are of opinion that the best prospect for the future of this Company is connected with the manufacture of iron; and there is now a very successful operation of this nature at Quinnimont, where the iron ore is brought about one hundred miles, the limestone nearly fifty miles—both by railway. The iron is smelted with coke from the coals of the mine, and the pig iron is taken a distance of eighty-eight miles by railway to Huntington, on the Ohio, where it is put into barges and taken up stream to Pittsburg, a distance of nearly three hundred miles further, and sold at $25 per ton, which leaves a profit, the cost of making it at Quinnimont being but $14 (*so printed*) per ton. The fact of iron made at so great a distance being able to compete with iron made on the spot at the Birmingham of America proves alike the capabilities of the district and the marketable quality of the iron.

There are also other evidences of the opinions with which the Americans themselves regard the district. Our nearest neighbor, Mr. Nuttal, an Englishman, having been engaged in coal mining for many years in Pennsylvania, has transferred his capital and operations to a spot six miles only from Hawk's Nest. General Gilmore, one of the United States engineers on the commission appointed to examine into the Central Water Communication alluded to in the report, is the proprietor of an estate adjacent to the Gauley property, while a Virginian gentleman, Mr. Newman, recently purchased 1,000 acres on the Gauley, immediately opposite to that of this Company, as the best investment he could find for his capital. There can be no doubt,

I consider, that property in this district must rise in value, and, I should think, rapidly.

* * * * * * * *

The chairman said they were in possession of a very valuable property, and the means had now been provided to render its resources available.

Mr. Wall, who had accompanied Mr. Clark to the colliery, (Gauley-Kanawha), said that one point had not been taken into consideration—that the resources of the property were developed. As to the sale of the coal in the Western markets, there were an enormous number of towns where consumption would be very great, and there need be no fear of sale as soon as it could be produced.

Also, in London, during a session of the Society of Arts, in 1873, concurrent testimony upon the great value of Virginia coal and iron deposits was given as follows:

"Professor Ansted, F. R. S., said it was nearly twenty years since he first visited Virginia, and examined some of its mineral riches. * * He could speak personally and positively as to the nature of the coal fields alluded to, which provided one of the greatest resources of mineral wealth of Virginia, and one which would no doubt prove in the long run the most important of all. They might form a good notion of the real value of this coal field by drawing a comparison between Virginia and England, two countries of nearly the same size. In Virginia the coal fields extended across the country from Northeast to Southwest—as if two-thirds of England were one coal-field—the coal not being difficult to work, involving very few mechanical difficulties with water, and scarcely any danger from explosions. The communications by railway were quite equal to those of England. It was true the coal fields did not come actually to the coast, but they reached almost to the Ohio and Mississippi, and he felt sure that the Mississippi itself would ultimately be as great a highway for America as the Atlantic was for England. There being easy communication with the Atlantic coast, he did not think it was too much to expect that in course of time Virginia would send over coals to England if the labor question remained as it then existed. At the present time they exported coal largely from Newcastle, from the neighborhood of England and South Wales, and he saw no reason why some of the great Appalachian coal fields should not export coal with equal convenience to England as we did to New York. For a very long time past the whole of the gas burnt in New York had been made of English coal, notwithstanding the facility they had for getting it from their own country; but if the price increased much more they would have to use their own. As to the existence of coal in Virginia there could be no question, but it had never been properly worked; indeed, there was no coal field which was more important, and, although there were places where the seams were thicker, there were none where they were more accessible or of a better quality; and he did not think it was always the case that the thickest seams were the most valuable.

The coal fields in the Appalachian range were nearly all horizontal, intersected by convenient valleys, and could be worked from numerous points at the same time with ease, and might be looked upon as inexhaustible. * * * * Virginia was also rich in iron fields of every variety and quality, and he saw no reason whatever why, if the same amount of energy and intelligence were applied to the manufacture of iron as in England, Virginia should not take precedence, in the present state of the labor market, in that important manufacture. Something of this kind must inevitably take place, unless things were altered, of which he saw no chance; and in this respect Virginia had the chance of being one of the most important States of America, and one of the wealthiest countries in the world: for, although up to a comparatively recent time it had been neglected, there was no reason for it so far as the physical condition of the country was concerned. No country had greater resources of wealth: for besides coal and iron there were other minerals, gold having been obtained in many districts with advantage, and it was certainly not yet exhausted. There were also copper, limestone, marble, salt and other earthy minerals, which he would not allude to. With all these advantages, he looked forward to Virginia being one of the countries of the future, and he was happy in being able to lend what assistance he could in pointing out these matters, because he had visited it at a time when it was much less populous than it was now, and had foreseen that when the coal was worked it must rise in importance.

"Mr. J. Bowron (Newcastle) said that two years ago he spent some months in Virginia, more particularly for the purpose of investigating its mineral resources, and he could concur in all the remarks of Professor Ansted. There was no doubt of the regularity of the coal fields throughout the whole of Western Virginia, while the country was so intersected with valleys that it was very easy indeed to open up at any point coal seams which could be readily identified with the same seams occurring twenty or thirty miles off. He himself followed one seam a long distance, and its regularity he could hardly have believed if he had not traced it. On approaching the Appalachian region he found such immense deposits of hydrated hematite ore as he had never seen elsewhere, though he was familiar with deposits of a similar kind in Cumberland and also in Spain. Besides these resources the capability of Virginia as a paper producing country were greater than he believed existed anywhere else. It had the materials at hand for producing those chemicals for which, at present, America depended mainly on England, being well supplied with metallic sulphurets, salt, limestone possessing ninety-eight per cent. of carbonate of lime, manganese, pure water and coal, and having these, it could not lack anything for chemical manufactures; and it possessed besides such a growth of non-resinous trees and plants, suitable for the manufacture of paper, that he had no hesitation in saying that the one State alone could easily supply paper for the whole of the civilized world.

"Mr. Newton said he had twice recently visited Virginia and Western Virginia, for the purpose of ascertaining its suitability as a colony for English agriculturists. He found that the land was richer than in England, and the

climate better; land could be bought for little more than one year's rent in this country; every crop that would grow here might be cultivated there, and some especial ones besides; there were as good markets, and every necessary could be obtained at a lower price. In fact, all that an English farmer wanted was a little capital to start with, and he could not fail of doing well there.

"Mr. Etheridge, F. R. S., referring to the recent statement of Sir William Armstrong, that under the present prices of coal England was paying what was equivalent to an annual tax of £45,000,000 on that article, drew special attention to the rich mineral resources of Virginia, and expressed his opinion that unless some solution of the difficulty could be found at home—and there was no absolute necessity for such famine prices, seeing that at the present rate of consumption our own coal fields would not be exhausted in less than 500 years—Virginia would, at no distant date, be found supplying the whole world with coal and iron."

OTHER MINERALS.

Gold.—The auriferous belt of Eastern Virginia is passed by the Chesapeake and Ohio Railroad in Louisa county, near Tolersville station. One and a half miles to the northward the Walton Mining Company still work the gold quartz vein from a shaft 150 feet deep, crushing and amalgamating two tons of quartz ore daily.

Copper and Iron Pyrites.—Just beyond the Walton mine, the Central Virginia Copper and Gold Company are operating more extensively. At date their mining work (shaft and winze) is 300 feet below ground surface, with good mining machinery—their veins at that depth running more into the copper sulphurets. The sulphurets (iron and copper) are in fact the only ores at present shipped to meet a steadily increasing demand from the copper and sulphuric acid works of the northern cities. Thirty-four hundred tons of these pyrites were shipped to New York, Philadelphia and Baltimore during 1875, and the shipments of 1876 are doubling these quantities. The best sulphuret ores analyze 47.70 sulphur, the residuum being mostly iron with a small percentage of sulphur. It is now contemplated to erect sulphuric acid chambers nearer the mines.

Lead and Antimony ores appear in Louisa county and elsewhere along the line, but the commercial demand has not warranted as yet any extended explorations to find them in quantity.

Manganese.—Deposits of manganese have been found in Louisa,

Augusta, Rockbridge, Bath, Alleghany and other counties. Shipments have been made in considerable quantity from Waynesboro' and Panther Gap stations. Some of these ores yield 77 per cent. bin-oxide of manganese (pyrolusite), or 7 per cent. above the usual commercial standard.

Salt, Building Material, Kaolin, Fire Clay, Cement, &c.—The Kanawha salt is too well known to require detailed description. From the earliest historical mention in 1753 to date, the reputation of the brines of this valley has been unusually well sustained for purity and strength. The Kanawha wells supply grades of salt equal to the best Turks' Island and better than Liverpool (Ridgway); and especially for the finer domestic uses, meat curing and butter manufacture.

The strength of the Kanawha brines is stated by Dr. J. P. Hale, of Charleston, West Va., to range from 6° to 12° by salinometer, Beaume scale. distilled water being zero; and from 8° to 10° for brines from which salt is now made. Another writer gives 45 gallons brine for one bushel of salt, or nearly double the strength of the Onondaga (New York) salt springs, from which domestic salt is largely manufactured, the coal being drawn from Pennsylvania. In the Kanawha Valley, the coal for the salt furnaces comes from the nearest hill. Wells are worked at depths ranging from 500 to 1,000 feet, and salt is produced, according to Dr. Hale. at an average cost of from eight to eleven cents per bushel, or thirteen to sixteen cents in barrels ready for shipment. The present capacity of the Kanawha furnaces is 2,500,000 bushels per annum, with convenient transportation to both eastern and western markets. The stress of the times has extended to salt manufacture, few of the furnaces now being worked to full capacity.

Bromine and chloride of calcium are made from the bitterns, or waste waters, from salt manufacture. Plans are also on foot to make here caustic soda and soda ash, using the pyrites ores from Louisa county, Va. This manufacture, as well as the history of the Kanawha salt production, is thoroughly reviewed in the communication of Dr. Hale to the West Virginia Centennial Commission.

The saline formation is traced far up the valley of New river,

salt springs and wells having heretofore been worked above the mouth of the Greenbrier. Gas wells have also been long known in the Kanawha Valley, and in instances have been used for heating salt furnaces. Petroleum has been found in several of the deeper wells, but has not attracted the same attention as in other localities on account of the more engrossing salt manufacture and coal mining.

Building Materials.—From the granites of Richmond to the limestones of the Valley and the fine sandstones of the Trans-Alleghany, there is nearly every variety of desirable building stone. Through the western division of the Chesapeake and Ohio Railroad there are quarries of indefinite extent immediately upon the roadside, where very fine-grained and durable sandstones can be loaded directly on cars at very low cost. There are also marbles and ornamental building stone in several localities. Among the more noted are those of Augusta county, Va., near Craigsville station.

Roofing slate has been quarried in large quanties near Keswick station, Albemarle county, Va. Ridgway describes it as of "soft nature, and some bands of it would be well adapted to working up into ornamental works of art."

Kaolin is found in considerable beds in Augusta county, six miles south of Fisherville, and was used for porcelain and pottery manufacture until the destruction of the works by fire not long since.

Hydraulic Cement was made from the cement limestones not far from Covington, and was used extensively in the masonry of the Chesapeake and Ohio Railroad.

Also, "not far from Swoope's station is a band of hydraulic limestone of good quality, as I demonstrated by actual test. It is already shipped and used for cementing purposes." Ridgway.

Fire-clays abound in the coal measures of New River and below, and pipe clays. Several analyses have been made of selected clays, which promise good fire-brick. No kilns however have yet been built. From the considerable local demand already for blast furnace and coke-oven linings, and the certain wants of the future, the

fire-brick manufacture suggests one of the best business openings on the line of the railroad.

WATER-POWER, INDUSTRIAL SITES, ETC.

A line like that of the Chesapeake and Ohio, ascending 2,000 feet in the first 200 miles of its course, and descending nearly 1,000 feet in the next 150 miles, crossing and bordering on numerous streams by the way, must, of course, abound in advantageous sites for the use of water as a motive power.

At Richmond there is abundance of water-power for three or four times the present manufactures; in fact, the available water-power of Richmond is said to exceed the entire mill privileges of Lowell and Lawrence combined.

The flour ground at the Richmond Flouring Mills, owing to the influence of climate, is greatly preferred over other brands for export to South America and other warm latitudes, and commands a correspondingly high price. The capacity of the 68 "run" of stones of three mills is 4,080 barrels per day, sufficient to freight a large ship; or 1,224,000 barrels per annum, requiring over 6,000,000 bushels of wheat. The flour business of Richmond may be largely and advantageously increased, now that the railroad makes western wheat available in that market at a low cost for transportation.

At the head-waters of the James River, also, nearly every mountain stream can be turned to account for milling or machinery purposes. The timber from the woods can be floated to the mill by water, and by water-power sawed into merchantable lumber.

Along the New River are numerous and effective water-powers and advantageous mill sites, many of which can be had with the adjacent land at the bare value of the land. So of its tributaries and affluents, the Gauley, Elk, Coal and Pocatalico Rivers.

No part of the country, probably, affords so fine a field for the mechanical industries in which iron, wood, coal, bleaching materials, hides, wool or cotton are employed, as may be found along the line of the Chesapeake and Ohio Railroad. The material, the power and the markets are all accessible under very favorable conditions.

Mr. Howell Fisher, in speaking of the water-power, says:

"Allusion should also be made to one peculiar facility incident to this river, resulting from the deep chasm cut by the waters, and which certainly can be found at but few other points. It is the use that can be so easily made of hydraulic means for the lifting and handling of heavy weights.

"To illustrate: At almost any point along the river the mountain streams can be turned into pipes with heads of (say) 300 feet, giving a pressure at the railroad level of (say) 125 pounds to the square inch. If you wish at any point to lift and handle weights of ten tons, you simply turn this water into a cylinder with a piston of eighteen inches, which will allow over thirty per cent. for friction, and it will lift the ten tons, and can be operated by any one who can turn a hydrant cock.

"At several points on New river there are natural falls, where water-power to the extent of from 5,000 to 10,000 horse-power can be had, and this power can be secured by artificial dams at almost any desired point.

"The great value of these powers can only be fairly understood when the fact is known that water-power is rated and paid for in the Middle and Eastern States at a rent of from twenty to fifty dollars per horse-power per annum, according to location.

"Even in works where not ordinarily considered desirable, water-power has been found profitable. In the manufacture of pig iron the waste gases have been thought to be all that could be wished as a means of power; but on the Lehigh, above Easton, there are five furnaces standing almost side by side, working precisely the same kind of stock—four worked by steam raised by the waste gases, and one worked by water taken from the Lehigh canal, for which the owners pay a water rent to the canal company, for the mere use of the water as a power, of $3,000 per annum, rather than use the waste gases for the purpose, and an experience of many years has shown that it is more profitable so to do.

"With this fine water-power, with the great breadth of excellent wool-growing country all along it, and with a short outlet east and west, so soon as population grows to give the necessary hands, the woolen industry will spring up and thrive; and while this location is some hundreds of miles nearer to the cotton fields of Georgia and Alabama than the seat of the present manufactories of this article, it is to be expected that in course of time a fair proportion of this industry will also be established; and it will not be many years before trains will be seen on the *Chesapeake and Ohio Railroad* wending their ways to the East and West, all of which—the locomotive, the cars, the freight, and the rails on which they run—have been constructed, manufactured and made on the line of the road."

CHESAPEAKE AND OHIO RAILROAD,
Office of Consulting Engineer,
RICHMOND, May 22d, 1876.

Gen'l W. C. WICKHAM, *Receiver:*

Sir—In preparing, pursuant to your instructions, an official paper upon the Chesapeake and Ohio Railroad and its resources, the pamphlet of Fisk & Hatch (New York, 1873), was taken as a basis. Upon a careful re-examination by the proper officers of the company, the larger portion of this pamphlet describing the road and road-bed, the topography of the country, and its agricultural and manufacturing resources, was found to have been so well done in the first instance, that it was preferred to hold the original text, save in the few modifications made necessary by some important changes from 1873 to 1876.

In the mineral division, coal and iron particularly, to meet many inquiries from experts and capitalists, it was deemed best to enter more closely into local description and technical detail, and to refer frequently to the actual working experience of the past two years. In doing this I have drawn either upon personal knowledge, or from the most reliable sources of information now accessible to the officers of this company, giving authorities for all material data quoted. For this portion of the preceding pages I am responsible.

Respectfully.

I. M. ST. JOHN,
Consulting Engineer.

CHESAPEAKE AND OHIO RAILROAD,
Receiver's Office,
RICHMOND, VA., June 10th, 1876.

Gen'l I. M. ST. JOHN, *Consulting Engineer, &c., &c.:*

Dear Sir—I have examined this pamphlet and approve it for publication. It is proper that I should add to what the paper contains by saying that our rates of transportation on coal, ore and metal are such as to foster the business and give satisfaction to those who handle them, and that the adoption of such a system of rates is and will continue to be the fixed policy of the company.

Your ob't serv't,

WMS. C. WICKHAM,
Vice-President and Receiver.

The Chesapeake and Ohio Railroad as a Route for Pleasure Travel: Its objects of Historic Interest and Curiosity, Magnificent Scenery, Mineral Springs and places of Summer Resort.

The completion of the Chesapeake and Ohio Railroad from Richmond to the Ohio River opened to tourists, invalids and persons seeking rest, change and enjoyment, one of the most charming and attractive routes for pleasure travel in the United States, and affords to business men and others, having occasion to travel between the East and the West, a most delightful route, opening to them, while pursuing their journey with speed and comfort, scenes and objects of interest until then inaccessible, except at considerable expense of time and money devoted expressly to the purpose of visiting them.

The Eastern portion of the route is thronged with historic associations and objects of national interest, and takes the traveler through and in sight of localities which have had a conspicuous place in our National History from the settlement of Jamestown and the days of Pocahontas, through the Revolutionary period, and the historic events of more recent years.

The scenery of the Blue Ridge, of the Valley of Virginia, and of the Alleghanies, is unsurpassed for beauty, grandeur and extent by anything which greets the traveler anywhere east of the Rocky Mountains. In approaching the summit of the Blue Ridge from the East in a clear day, there is afforded an unbroken view of hill, valley, table-land and cultivated fields, extending as far as the eye can reach, and of rare beauty. The passage through the great valley and the ascent of the Alleghanies afford a constant succession of objects of interest and attraction.

From Staunton to the celebrated White Sulphur Springs, the road winds among a remarkable succession of hills and valleys, the interest of which, in addition to their scenic effects, is heightened by the immense wealth of iron ores with which they are known to be filled.

West of the White Sulphur Springs the route enters a region of

wonder and beauty, rendered accessible to the ordinary traveler for the first time, by the recent opening of this portion of the road; and until then unknown to tourists, except to a few, venturesome enough to shoot the rapids of the rivers in batteaux, or ride along their narrow banks on mules.

For nearly forty miles the road follows the Greenbrier river, here shut in by mountains and cliffs, and there coming suddenly upon beautiful openings and fertile bottoms, to its junction with the more turbulent and wild New river, whose banks it then follows closely for sixty miles, to where, in its junction with the Gauley, near Hawks Nest, it becomes the Great Kanawha.

The gorge or canon of the New river affords one of the most remarkable and fascinating experiences in railroad travel which can be found on the continent, and one which no traveler, having once enjoyed, would feel that he could afford to have missed.

It is no ordinary valley, but an actual chasm, down into the bowels of the earth, whose natural surface of table-land and rolling country is above the river and the railroad from 500 to 1,000 feet; and whose geological strata of coal, iron and limestone crop out on the sloping or perpendicular sides of the cut from 100 to 300 feet above the level of the track.

The road follows the natural curves of the river, which are broad, graceful and easy, down upon its banks, never losing sight of it, except when dashing for a moment through a tunnel or cut where some projecting spur of the enclosing mountains has left no bank for the road bed, or rendered the curve too sharp.

The mountains rise on either side in steep slopes or perpendicular bluffs, divided by frequent valleys and ravines coming down to the river level, and sparkling with mountain streams and water-falls. The windings of the road, through this wonderful gorge, with the flashing river always before, behind and beside you, and the forms of the enclosing hills and cliffs changing with each new curve and altered point of observation, presents a panorama which is very wonderful and thrilling—a sort of giant kaleidoscope in which vast objects are whirled about and combined in gorgeous transformations like the bits of colored glass in the child's toy.

Just below Miller's Ferry the road crosses the New river—whose

right bank it has hitherto followed—in sight of the famous "Hawk's Nest." A little further down, the New river and the Gauley join their waters and become the Great Kanawha, whose left bank the road now follows for 40 miles further, through the great Kanawha coal fields, past Kanawha Falls to Charleston, the capital of West Virginia, a thriving and growing city of about 6,000 inhabitants. Sixteen miles below Charleston the road leaves the river, and strikes across a rolling country to Huntington, its terminus on the Ohio.

Here, where three years ago there were only a few scattered farm-houses, is now a busy and growing city of 3,000 inhabitants, which from its favorable location on the river, its healthfulness and its unsurpassed facilities for the various industries requiring cheap iron, fuel, lumber and transportation to market, is destined to become one of the most important centers of manufacture and trade in the Ohio Valley.

Mineral Springs.

Between Staunton, in the Valley of Virginia, and the junction of the Greenbrier and New rivers, in West Virginia, on the line of the road, and at distances from it varying from two to thirty-seven miles, is probably the most remarkable collection of Mineral and Medicinal Springs in the world. Many of them have been long known and frequented by invalids and seekers after health and pleasure, and are celebrated for their medicinal properties, and their wonderful curative effects.

The summer climate of this region of the Springs is delightful, being cool, dry and invigorating, and remarkably healthy. Its elevation, of about 2,000 feet above the level of the sea, exempts it from the extreme heat of summer, and gives a purity and bracing character to the atmosphere, which is felt at once, and long remembered by those who visit it in summer.

The most important and most widely known as a summer resort is the celebrated Greenbrier White Sulphur, situated directly on the line of the road, six miles West of where it crosses the summit of the Alleghanies, 227 miles West from Richmoud, and 194 miles East from Huntington. The hotel and cottages connected there-

with have accommodations for about 2,000 guests, to which large additions are being made to accommodate the increased number of visitors which the opening of the road through to the West has brought.

There are numerous other resorts of established reputation for the medicinal properties of their waters, and for good accommodations, pleasant surroundings, and agreeable society.

Below will be found a list of the various Springs and points of interest, stage connections, distances from the railroad, accommodations for guests, and names of hotel proprietors, which may be of assistance to persons proposing to visit them during the coming season.

The Mineral Springs of Virginia, though chiefly known in years past as the favorite watering places of the people of the South, have within a few years been growing in popularity with those of the North and East, especially since the opening of the Chesapeake and Ohio Railroad, from Richmond to White Sulphur, in 1869.

Until recently, these Springs and places of resort, so peculiarly adapted to the wants and tastes of the people of the West and Southwest, have been accessible from that direction only by long stage coach journeys. The opening of the road through to the Ohio river brings them within less than twenty-four hours from Cincinnati, and makes them the great watering places of the West.

Now, that they lie midway upon a great through route of travel between the East and West, and can be visited for a day or two at a time by thousands of people passing to and fro, and taken *en route* between the great centres of business and population on the Atlantic Coast and in the Mississippi Valley, their celebrity has been widely extended, and they form a meeting point and social centre for people from all sections of the country, unequalled, in their natural attractions, their facilities for health, rest and pleasure, and the society which they bring together, by any of the famous watering places of America.

Tickets are now on sale at all of the Principal Ticket Offices, *East* and *West*, thus affording all persons traveling in either direction an opportunity of visiting them, and, at the same time, of

effecting a great saving in the cost of their tickets, as the rates by this line, *via* Richmond, between Southern and Western points, are from three to seven dollars less than by any other route, while they are the same as those of other lines between Western points and those North and East of Richmond.

Distance Table to the Various Springs and Points of Interest.

Names of Springs.	County.	Distance from R. R. Station.	Nearest Railroad Station.	Capacity of Accommodation.	Conveyance from Station.	Hotel Proprietors.
Bath Alum Springs.....	Bath.....	10	Millboro'.....	200	Stage.	Joseph Baxter.
Capon Springs.....	Hampshire...	15	Capon Road.....	500	Stage.	Frazier & Sale.
Cold Sulphur Springs.....	Rockbridge...	2	Goshen.....	100	Stage.	W. H. Waddell.
Healing Springs.....	Bath.....	16	Covington.....	250	Stage.	W. B. Bishop.
Hot Springs.....	Bath.....	20	Covington.....	350	Stage.	J. A. August.
Jordan Alum Springs.....	Rockbridge...	5	Millboro'.....	350	Stage.	J. B. Tinsley.
Kanawha Falls.....	Fayette.....	0	Kanawha Falls...	100	.....	Peyton & Page.
Natural Bridge.....	Rockbridge...	36	Goshen.....	100	Stage.	Wm. Stephenson.
Orkney Springs.....	Shenandoah..	12	Mt. Jackson.....	500	Stage.	J. N. Woodward.
Rawley Springs.....	Rockingham.	11	Harrisonburg....	400	Stage.	G. W. Bunker.
Red Sulphur Springs.....	Monroe.....	12	Talcott.....	150	Stage.	W. Adair & Co.
Rockbridge Alum Sp'gs..	Rockbridge...	6	Millboro'.....	500	Stage.	J. A. Frazier.
Rockbridge Baths.....	Rockbridge...	11	Goshen.....	150	Stage.	A. A. Pitman.
Shenandoah Alum Sp'gs..	Shenandoah..	12	Mt. Jackson.....	200	Stage.	A. J. Myers.
Stribling Springs.....	Augusta.....	13	Staunton.....	200	Stage.	Chesley Kinney.
Sweet Springs.....	Monroe.....	10	Alleghany.....	700	Stage.	Oliver Beirne.
Sweet Chalybeate Sp'gs...	Alleghany....	9	Alleghany.....	300	Stage.	Parke & Stack.
Warm Springs.....	Bath.....	16	Millboro'.....	250	Stage.	J. L. Eubank.
Weyer's Cave.....	Augusta.....	4	Weyer's Cave St..	....	Stage.	A. Mohler.
White Sulphur Springs...	Greenbrier...	0	White Sulphur...	2000	.....	G. L. Peyton & Co.

STAGE CONNECTIONS.

At Staunton, for Stribling Springs.

At Goshen, for Lexingnon, Rockbridge Baths, Natural Bridge and Cold Sulphur Springs.

At Milboro' or Goshen, for Rockbridge Alum Springs and Jordan Alum Springs.

At Milboro', for Bath Alum Springs and Warm Springs.

At Milboro' or Covington, for Healing Springs and Hot Springs.

At Alleghany, for Sweet Springs and Sweet Chalybeate Springs.

At Talcott, for Red Sulphur Springs.

List of Stations on Line of Chesapeake and Ohio Railroad, with Elevations above Tidewater and Distances from Richmond.

STATIONS.	Elevation.	Dist. from Richmond.	STATIONS.	Elevation.	Dist. from Richmond.
Richmond	30.03	0	Williamson's	1,053.00	192.62
Hunslett	100.00	5.50	Jackson's River	1,135.00	195.07
Atlee's	201.00	8.85	Lowmoor	1,155.00	196.75
Ashcake	199.00	12.41	Steele's	1,210.00	200.07
Peake's	194.00	14.76	Covington	1,245.00	205.41
Hanover	82.00	18 24	Callaghan's	1,427.00	210.86
Wickham's	76.00	20.95	Backbone	1,690.00	215.36
Southanna	68.00	22.76	Alleghany	2,050.00	221.70
Junction	134.00	27.54	White Sulphur	1,919.64	227.15
Anderson's	221.00	30.39	Caldwell	1,765.00	232.60
Noel's	254.00	33.34	Ronceverte	1,660.00	237.90
Hewlett's	276.00	35.38	Fort Spring	1,625.00	244.32
Beaver Dam	282.00	40.06	Alderson	1,550.00	251.14
Green Bay	326.00	42.88	Mason's Mill	1,527.00	259.28
Bumpass'	329.00	45.00	Lowell's	1,510.00	260.75
Buckner's	321.00	46.94	Talcott	1,510.00	262.50
Frederick's Hall	348.00	50.21	268 Mile Post	1,434.00	268.00
Tolersville	461.00	56.31	Hinton	1,377.00	272.69
Louisa	452.00	62.08	New River Falls	1,290.00	281.58
Trevilian's	524.00	66.49	Meadow Creek	1,265.00	285.00
Green Springs	526.00	69.70	Paw-Paw	1,237.00	289.60
Melton's	538.00	72.61	Quinnimont	1,196.00	294.26
Gordonsville	498.00	75.81	Siding	1,150.00	297.69
Lindsay's	477.00	80.69	Buffalo	1,109.00	300.48
Cobham	401.00	82.90	Dimmock	1,045.00	307.46
Campbell	348.00	85.83	Sewell	1,004.00	312.81
Keswick	435.00	89.58	Nutallburg	948.00	316.86
Shadwell	503.00	92.96	Fern Spring	914.00	318.75
Charlottesville	451.00	96.81	Fayette	908.00	319.25
Lynchburg Junction	485.50	97.68	Hawk's Nest	828.00	324.09
Ivy	516.60	104.30	Cotton Hill	896.00	326.20
Mechum's River	550.00	107.26	Kanawha Falls	672.00	333.31
Greenwood	1,225.67	114.95	Loup Creek	647.00	337.18
Afton	1,377.38	119.71	Cannelton	636.00	342.69
Waynesboro'	1,284.42	123.90	Paint Creek	622.00	348.15
Fisherville	1,321.00	128.95	Blacksburg	626.00	350.37
Staunton	1,387.18	136.38	Coalburg	625.00	352.76
Swoope's	1,653.00	144.31	Lewiston	616.00	356.10
Siberton	1,885.00	147 26	Brownstown	508.00	359.83
No. Mountain	2,060.00	149.50	Alden	565.00	363.53
Variety	1,905.00	151.97	Salton	608.00	366.00
Elizabeth	1,812.00	153.33	Charleston	602.00	369.17
Pond Gap	1,677.00	155.15	Spring Hill	600.00	374.85
Craigsville	1,516.00	159.35	St. Alban's	594.00	380.91
Bell's Valley	1,507.50	164.44	Scary	590.00	384.69
Goshen	1,410.00	168 44	Scott	683.00	388.56
Panther Gap	1,590.00	171.50	Hurricane	683.00	394.55
Millboro'	1,679.50	175.51	Milton	586.00	401.17
Mason's Tunnel	1,550.00	177.39	Thorndyke	640.00	404.27
Crane's	1,361.00	181.50	Barboursville	580.00	410.09
Griffith's	1,165.00	186.00	Guyandotte	560.00	416.69
Longdale	1,150.00	188.14	Junction Switch	560.00	417.94
Peter's	1,175.00	189.70	Huntington	566.50	421.03
Clifton Forge	1,047.50	191.50			

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